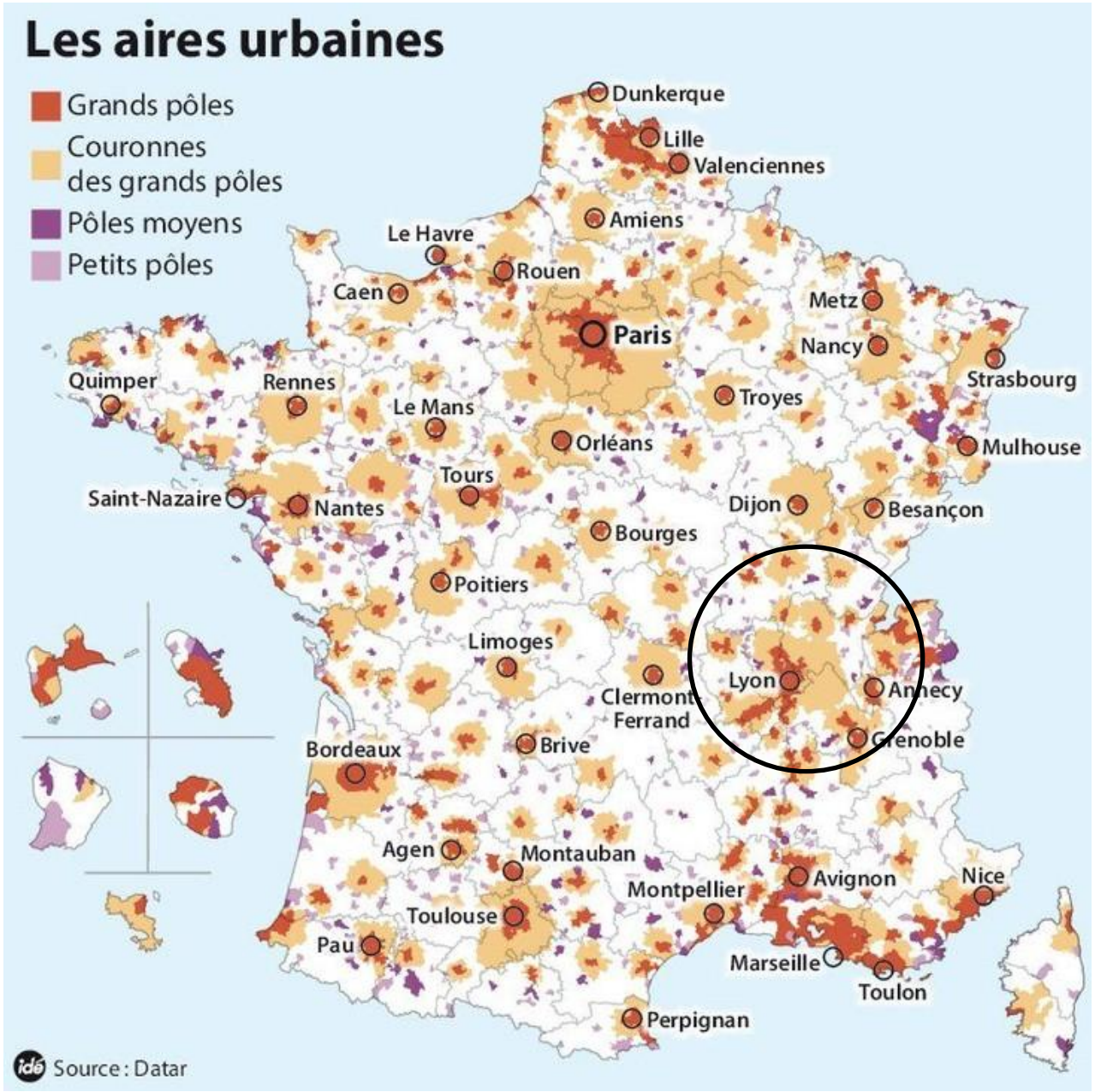
Highrise WP1

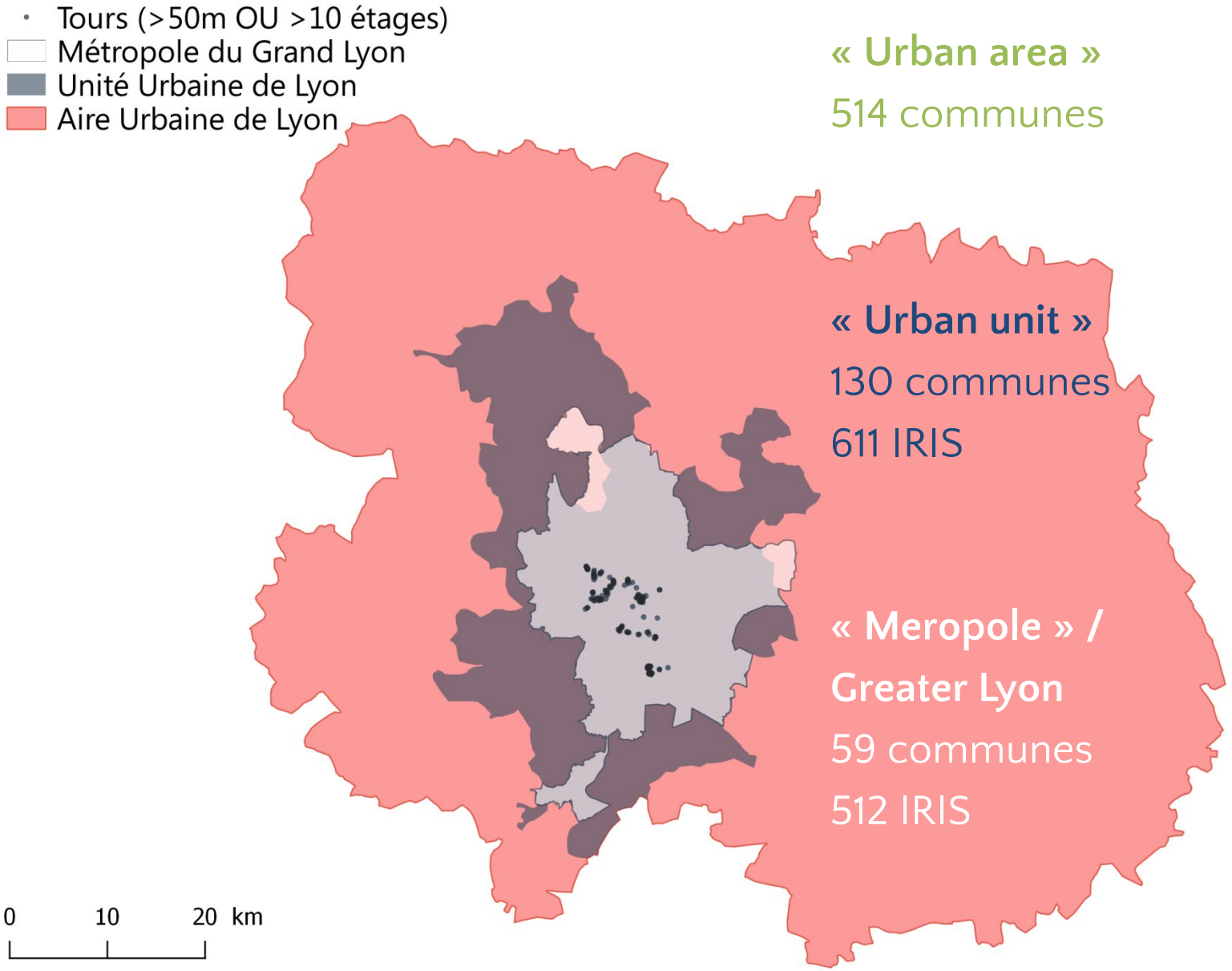
Baptiste Girault &Mélanie Mondo
Manuel Appert &Hélène Mathian

1- Reminders- framing data for Lyon:
   -Towers
   - Social data
2- IDH
3- Socio-spatial approaches in Lyon & London
4- Sattelites images
5- Others analysis
   - Clustering
   - Toward a morphology description
6- accessibilities

French urban delineations



Lyon: different zonings



« Urban area »

514 communes

6 036 km²

371 hab/km²

« Urban unit »

130 communes

611 IRIS

1 185 km²

1 351 hab/km²

« Meropole » / Greater Lyon

59 communes

512 IRIS

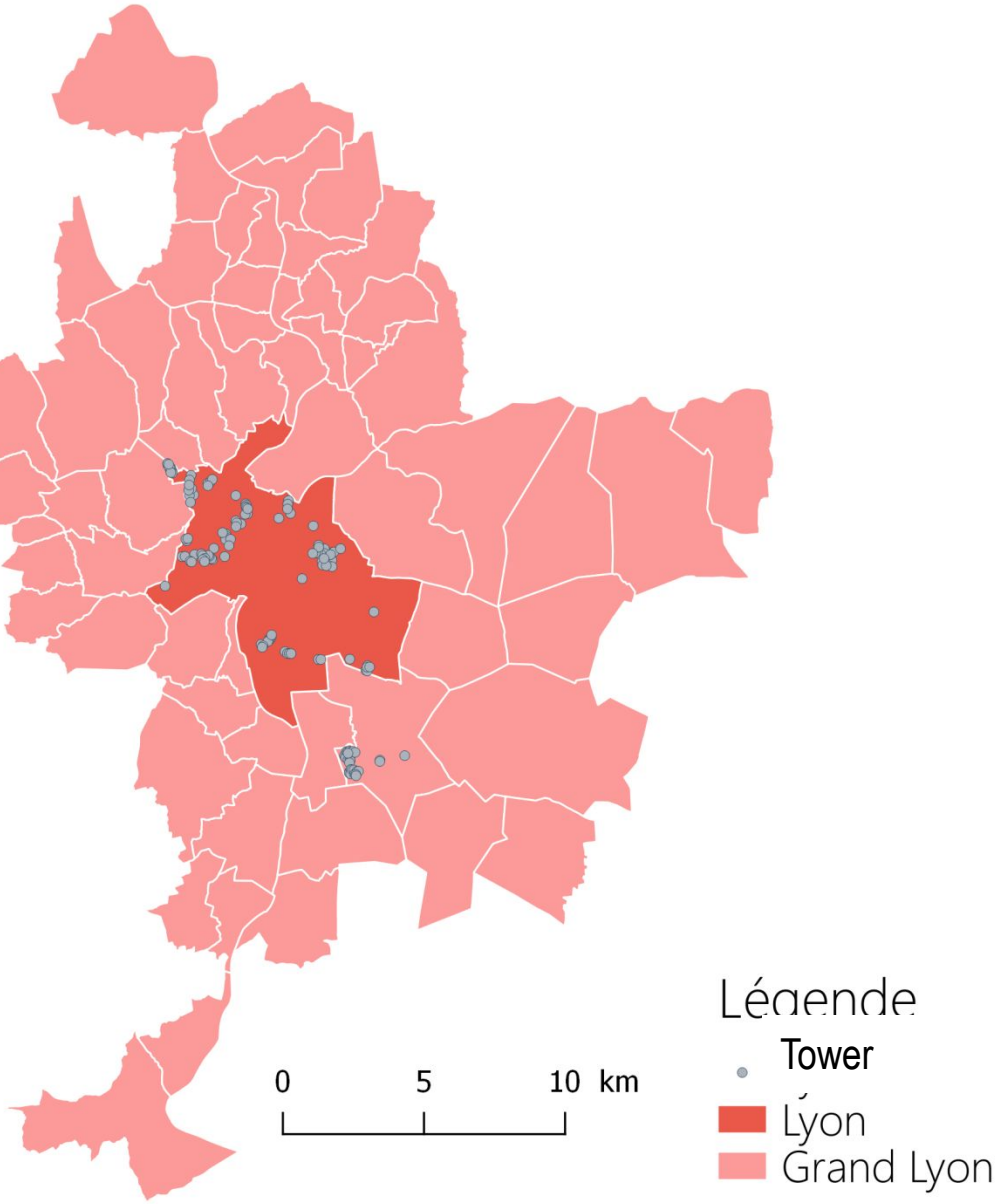
496 km²

2 668 hab/km²

1 551 000 inhab

59 communit

~152 Tower



Towers and database

- *« … les immeubles retenus vont avoir une hauteur architecturale supérieure à 50 mètres ou un nombre d'étage supérieur à 10 (« Construction...en hauteur ») dotés de fonctions ; résidentielles. de bureau. administratives. d'hôtellerie ou mixtes (« Construction habitée ») » (rapport de stage 2014 & 2015 programme SKYLINE)*

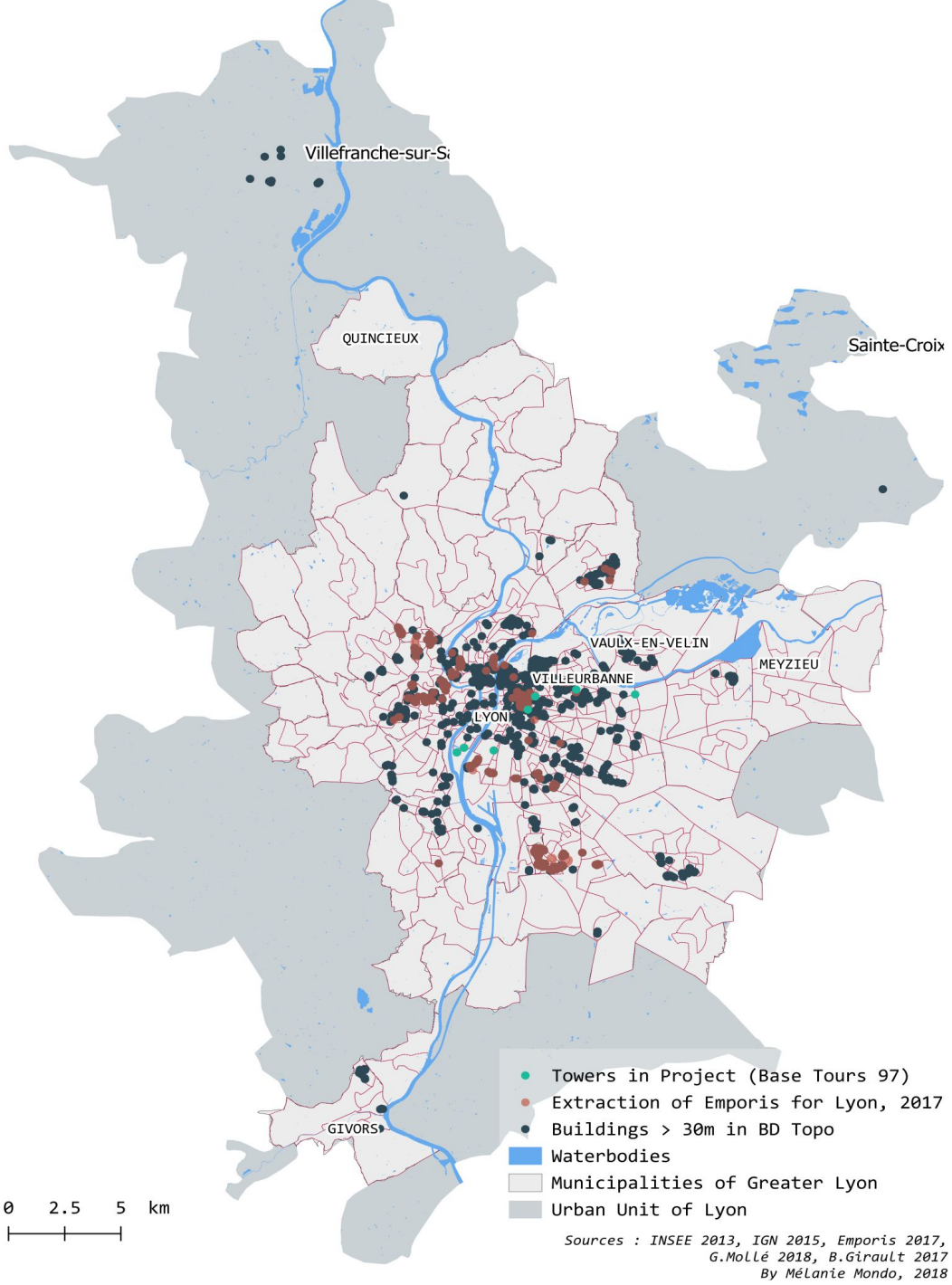
- **Emporis DataBase** (© Emporis) Buildings higher than 30m =France. Lyon and London – Enriched with projects
- **BD Topo** (IGN) for Lyon (selection of buildings > 30 m).

Comparison of DataBases

BD TOPO			Common buildings	Emporis		Differences
Criterium	Nb of buildings	Average height		Nb of buildings	Average height	
>= 30m	979	36.07	166	217	55.99	813
>= 40m	259	46.06	120			139
>= 50m	33	57.03	17			16

For the highest, most of differences are linked to definition of the unit and of the height

High buildings according to different DB



- **Current Database:**

Emporis enriched with:

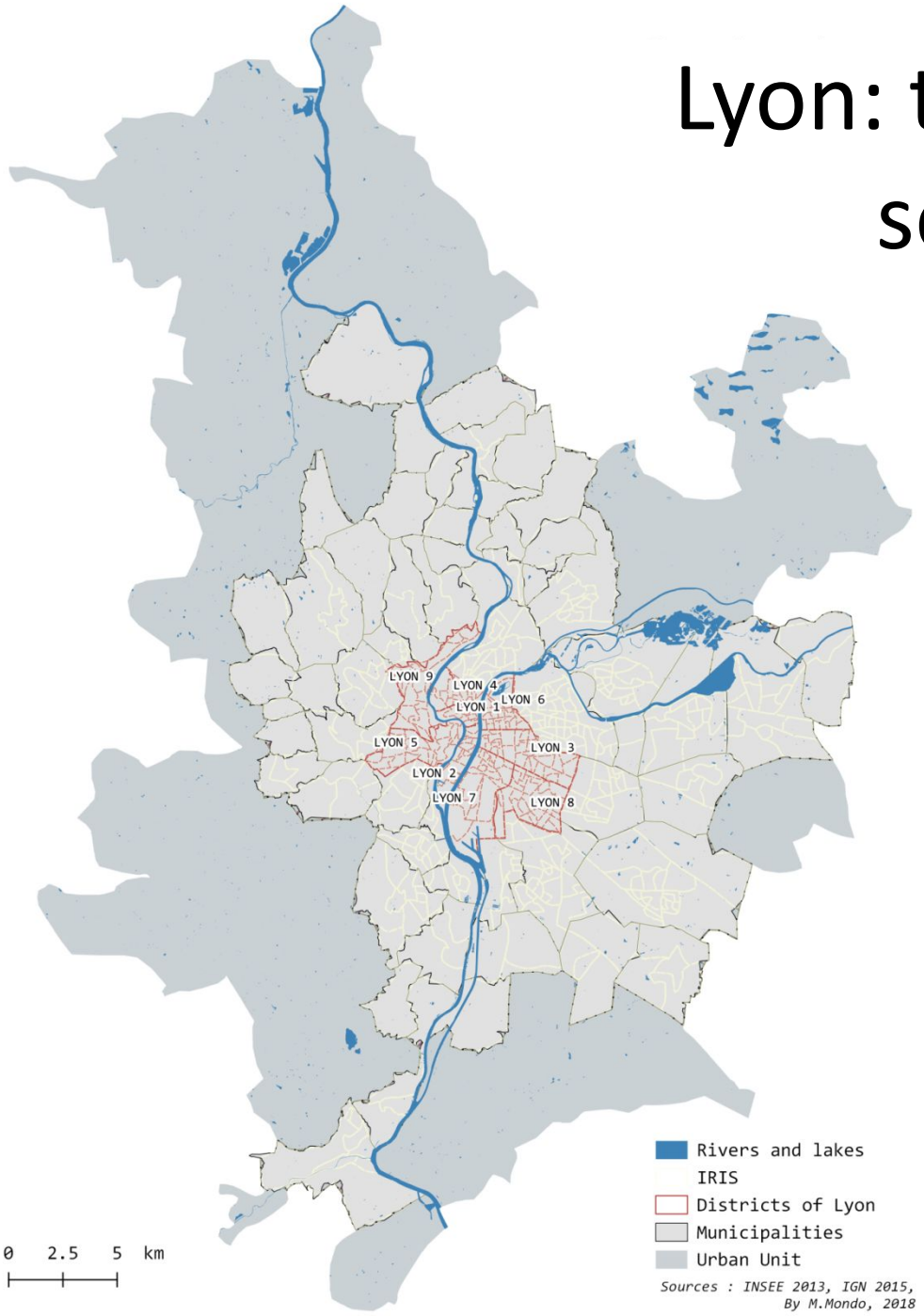
- **Buildings of BDTOPO not in EMPORIS higher than 50m**
- **Buildings in project (G.Mollé)**

Heights

		Min	25%	Median	Mean (50%)	75%	Max	sd	Coef. of variation	Mode	Total
London	Emporis	31	39	48.05	58.07	63.89	385.60	32.07	55.23	35	2288
France	Projet	47.89	50.35	55	54.6	56.40	99	6.31	NA	55	97
	Emporis	27	41.89	48.93	52.50	57.70	425	20.79	39.60	44.12	5613
Lyon	Emporis	34.95	47.52	52.42	54.17	57.70	200	16.29	30.06	57.7	217
	BD Topo bat>30 m	30	31	33	36.07	40	138	7.46	20.68	30	990

	Office			Residential			Significance
	N	Height Mean (m)	Standard deviation	N	Height Mean (m)	Standard deviation	
Lyon	20 (9.34%)	86.38	54.91	193 (90.19%)	52.34	6.58	***
France	369 (6.57%)	50.55	20.78	5154 (91.82%)	50.48	12.97	***
London	560 (24.47%)	65.10	40.08	1405 (61.41%)	54.09	24.84	***

Lyon: the zonings for social data



Greater Lyon=

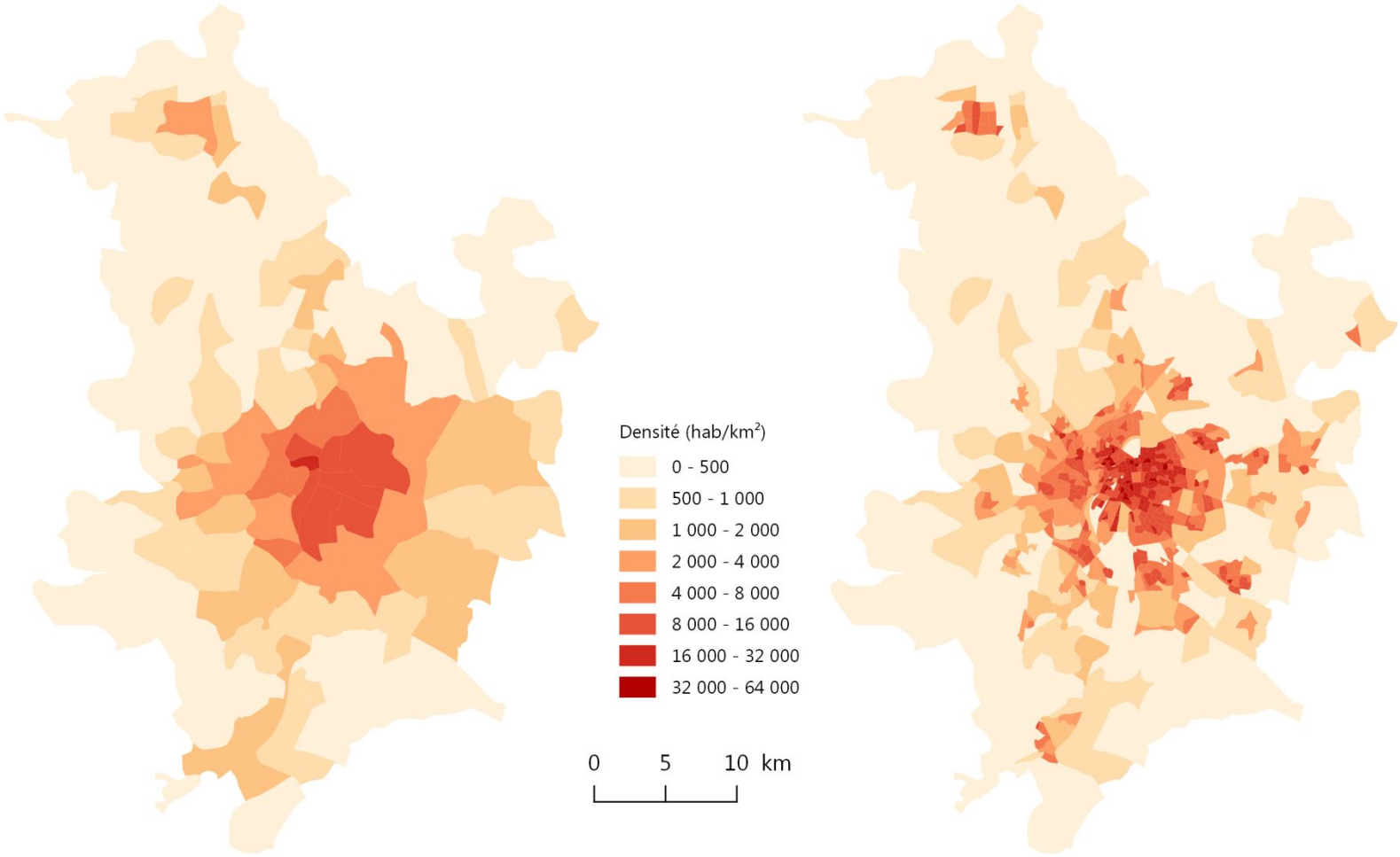
- 59 communities
  whose LYON (9 arrondissements)
- 518 IRIS zones
  Whose LYON= 185

IRIS= Ilots regroupés pour l'information statistique
> 2000 inhabitants (INSEE)

Densities in the urban unit

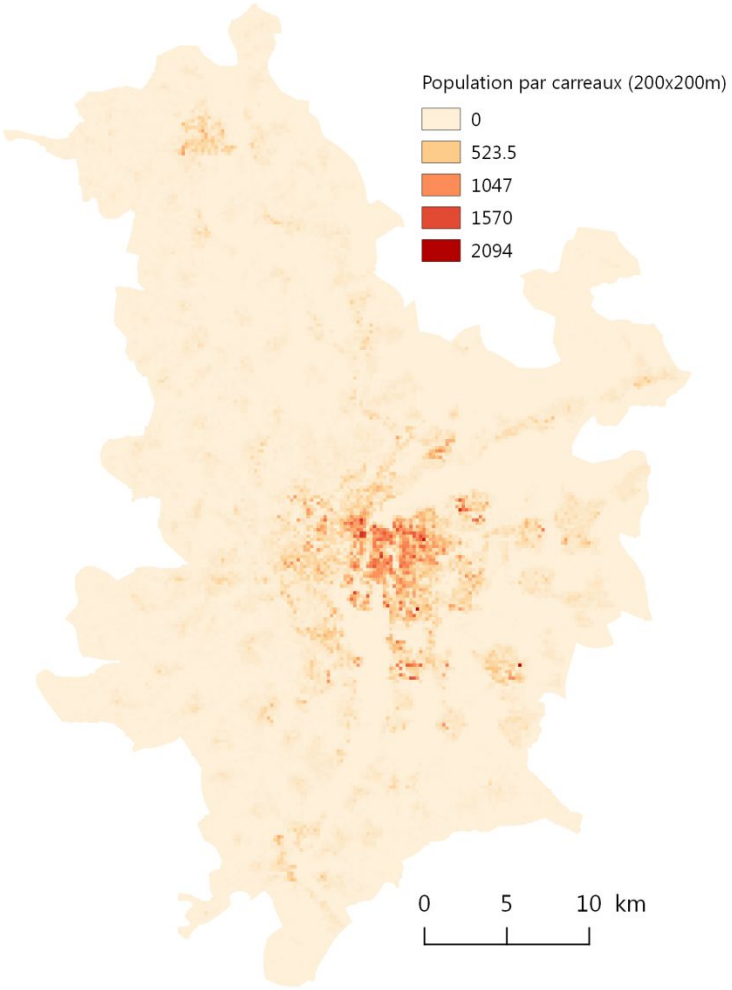
Communes

Iris

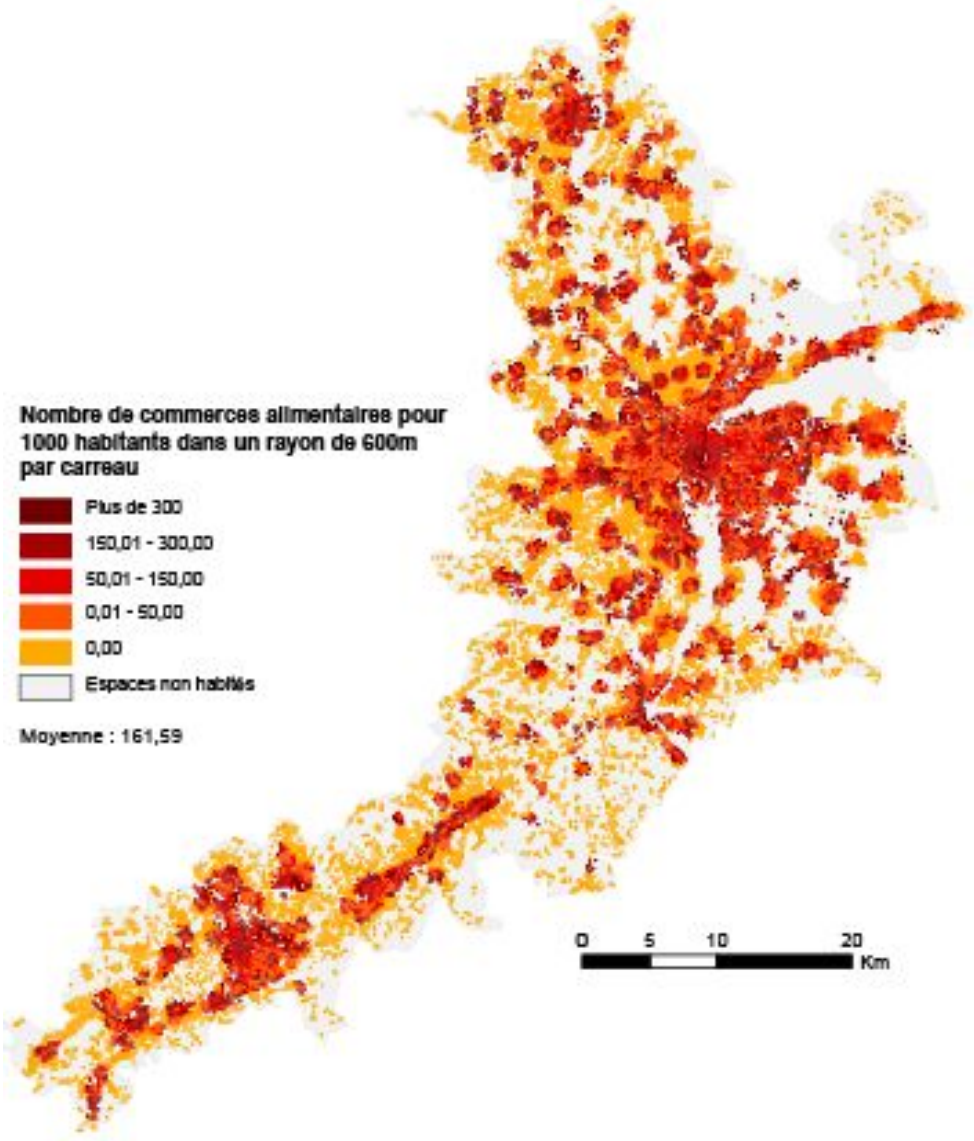


Densities in the urban unit

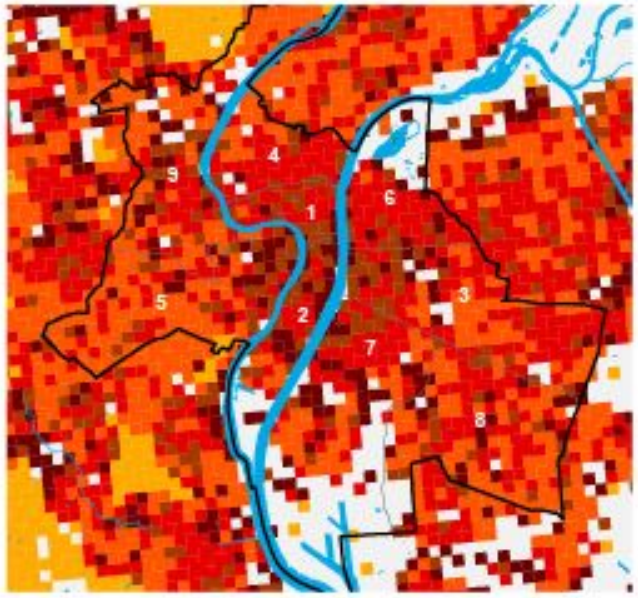
Square grid



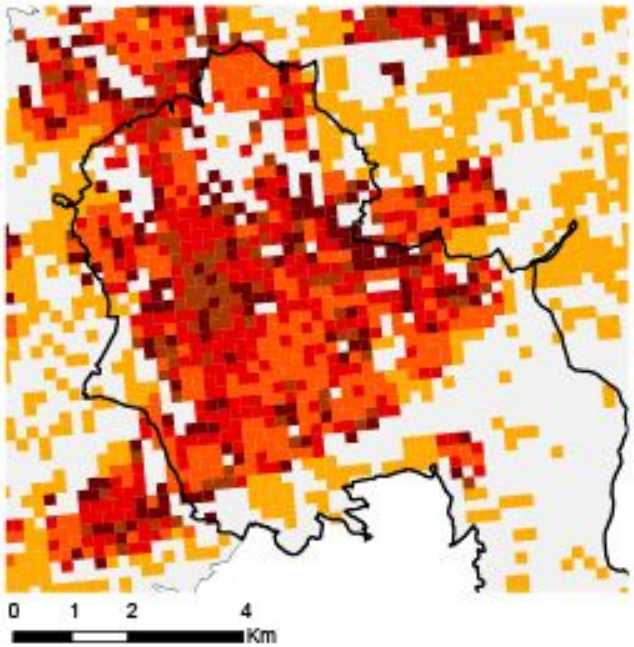
Exemple: commercial accessibility in « Lyon/Saint-Etienne area »



Lyon



Saint-Etienne

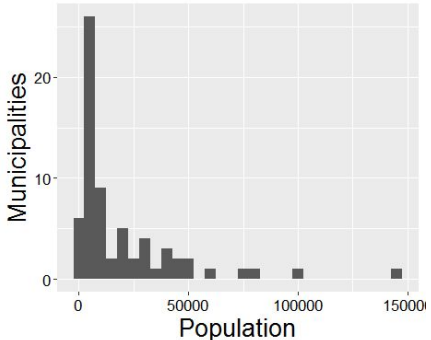


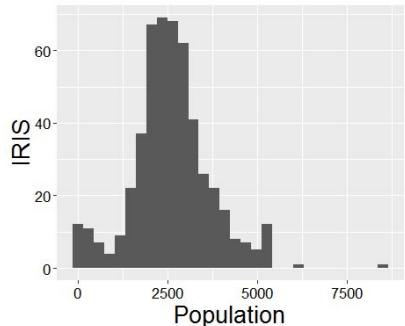
Metropolitan area - Greater Lyon

Name	Level 1-Municipalities	Level 2-IRIS	Population	Area (km²)	Built up area (km2)	Number of jobs	Number of residents employed	Population density (inh./km2)	Built-up Area/Area	Built up density of population
Greater Lyon	59	512	1 324 641	537.53	52.48	683 301	552626	2464.30	0.10	25240.87
Lyon (municipality)	1	185	496 342	47.70	11.19	350 066	221637	10 3608.91	2.22	414532.03
Whose districts of Lyon :										
Lyon 1er		11	29 210	1.51	0.54	21 683	14234	19 395.75	0.36	54092.59
Lyon 2e		15	30 958	3.47	0.88	22 405	13395	8911.34	0.25	35179.55
Lyon 3e		32	98 137	6.28	2.05	71 281	46777	15 636.87	0.33	47871.71
Lyon 4e		15	36 240	2.93	0.65	24 193	16860	12 360.16	0.22	55753.85
Lyon 5e		21	46 692	6.14	1.05	31 489	19016	7 609.52	0.17	44468.57
Lyon 6e		21	49 477	3.76	0.91	33 352	21653	13 148.29	0.24	54370.33
Lyon 7e		24	75 746	9.43	2.21	57 060	35909	8 036.71	0.23	34274.21
Lyon 8e		27	81 453	6.83	1.58	55 596	33127	11 925.77	0.23	51552.53
Lyon 9e		19	48 429	7.36	1.31	33 007	20666	6 584.50	0.18	36968.70

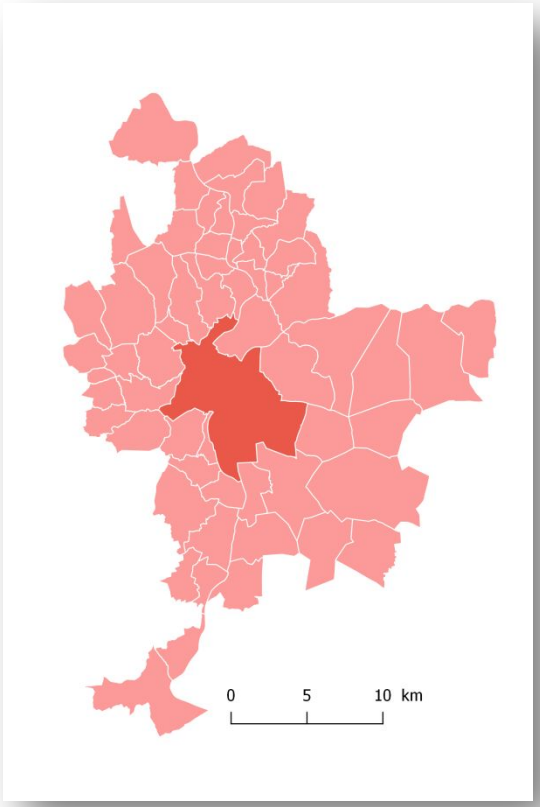
INSEE,2012

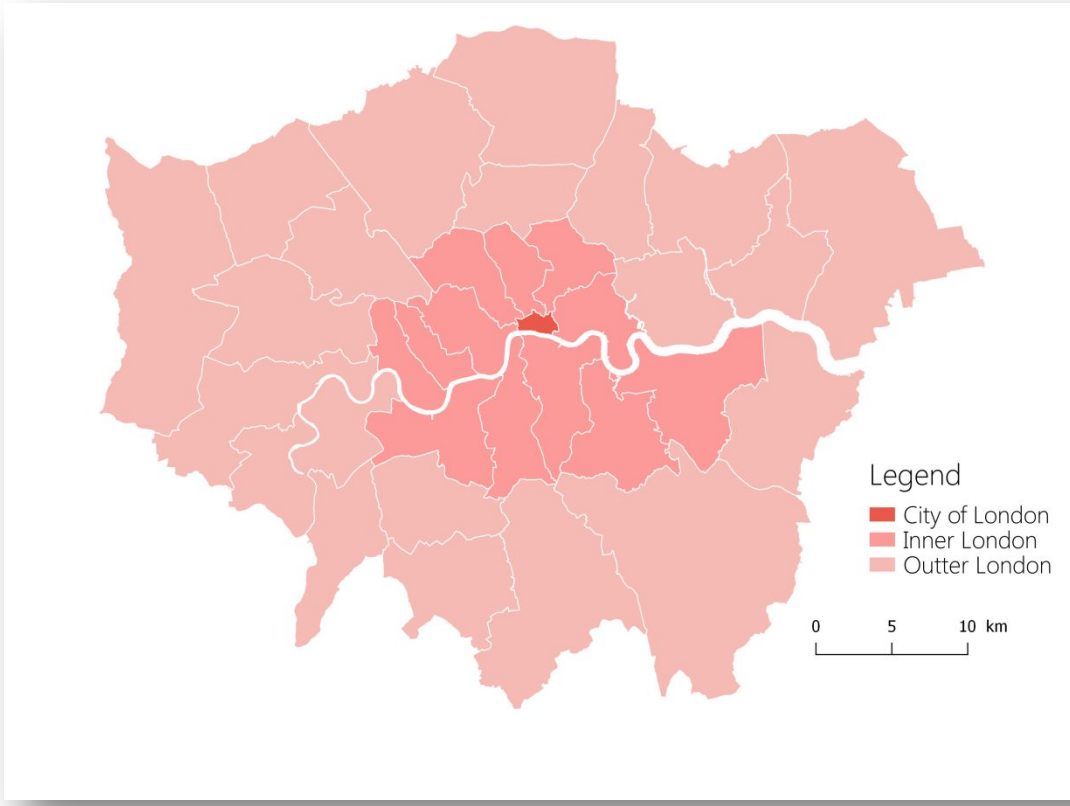
Distribution of the population
Of Greater Lyon according to the 2 zonings:
- Municipalities
- IRIS





Two fields

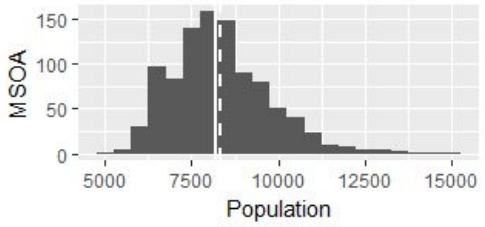

0
5
10 km

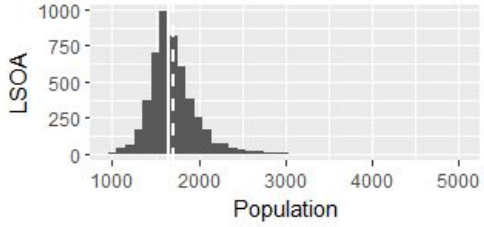

Legend
City of London
Inner London
Outter London
0
5
10 km

Greater London

Lower layer Super Output Areas (LSOA)
and Middle layer Super Output Areas (MSOA

	Greater London
Borough (political)	33
Ward (political)	625
OA (statistical)	25 053
LSOA (statistical)	4 835
MSOA (statistical)	983
Area (km²)	1 573.5
Total population	8 204 407
Population density	5 214





IDH

	LONGEVITY	EDUCATION		INCOME
		Adult population	Population of young people	
IDH (PNUD)	Life expectancy at birth	Mean years of Schooling 25+	Expected years of schooling	The national mean income per capita (US$ ppp2005)
IDH-M (Brasil)	Life expectancy at birth	18+ with primary education completed	5-6 attending school 11-13 attending the final years of primary education 15-17 with primary education completed 18-20 with secondary education completed	Monthly income per capita (R$ Aug/2010)
IDH-2 (France)	Life expectancy at birth(M/W)	15+ out of school with diploma	///	Median tax household income per consumption unit (in €, translated into $US and ppp)

IDH-M

- IDH adapted to Brasil

Income index :

$$\frac{[ln\,(valeur\ observée\ de\ l'indicateur)\ -\ ln\,(valeur\ minimale)]}{[ln\,(valeur\ maximale) - \ln(valeur\ minimale)]}$$

où les valeurs minimales et maximales vont de 2.10 € et 1 063.10 € (aux prix d'août 2010).

Education index:

$$\sqrt[3]{Education(Adult\ population) * Education(Young\ People)^2}$$

moyenne géométrique de l'indice de fréquence des enfants allant à l'école. avec un poids de 2/3. et de l'indice d'éducation de la population à l'âge adulte. pesant pour 1/3.

Life expectancy index :

$$\frac{[(\text{valeur observée de l}'\text{indicateur})\ -\ (\text{valeur minimale})]}{[(\text{valeur maximale})\ -\ (\text{valeur minimale})]}$$

où les valeurs minimales et maximales sont de 25 ans et 85 ans. respectivement.

IDH-2

- Local version of IDH adapted by the urban community of Greater Lyon

Income index :

$$\frac{[\log(median\ income\ uc)\ -\ log\ (5000)]}{[log\ (25000) - \log(5000)]}$$

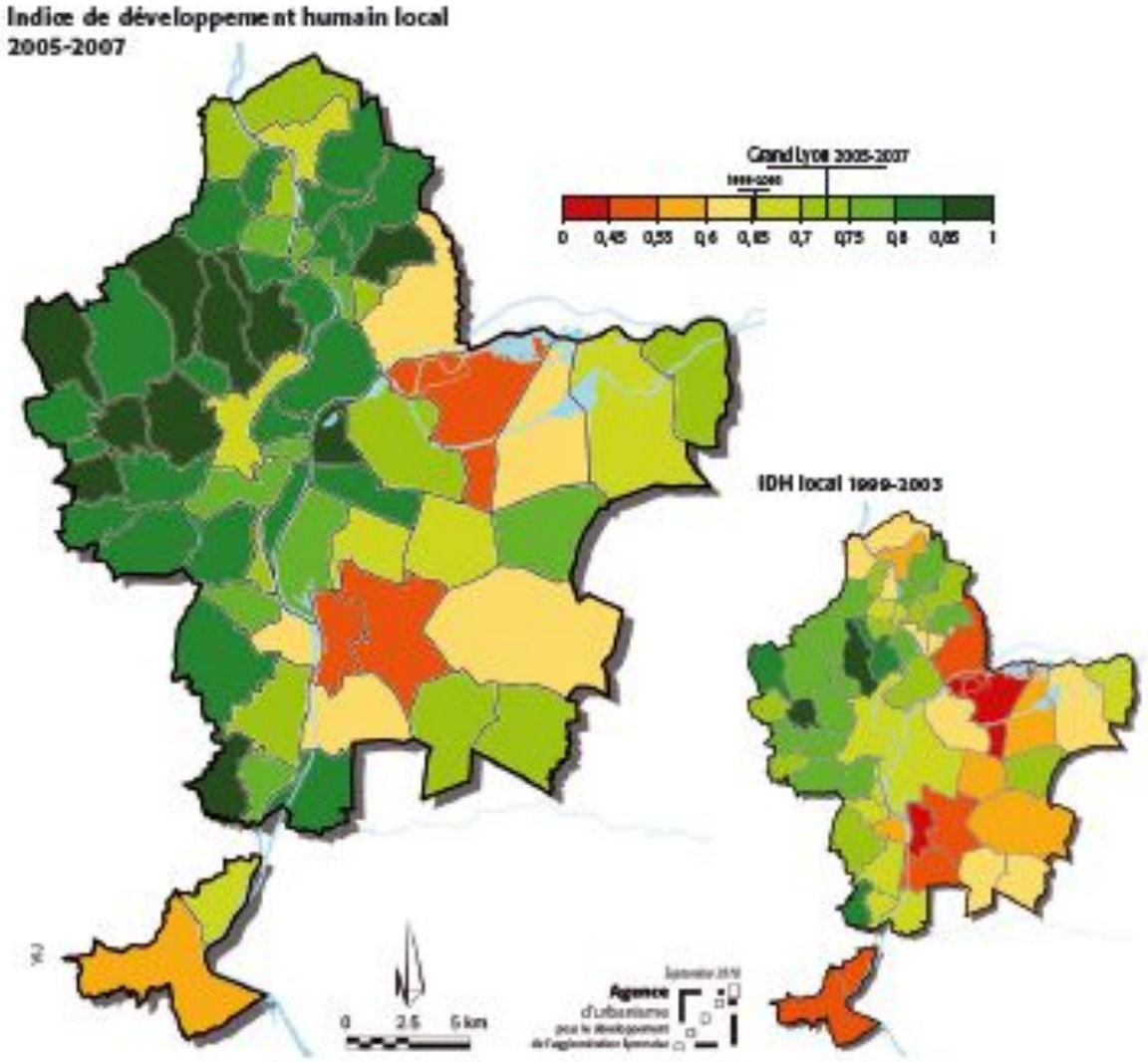
Education index :

$$\frac{(\%graduated\ pop > 15\ years\ - 50)}{100 - 50}$$

Life expectancy index :

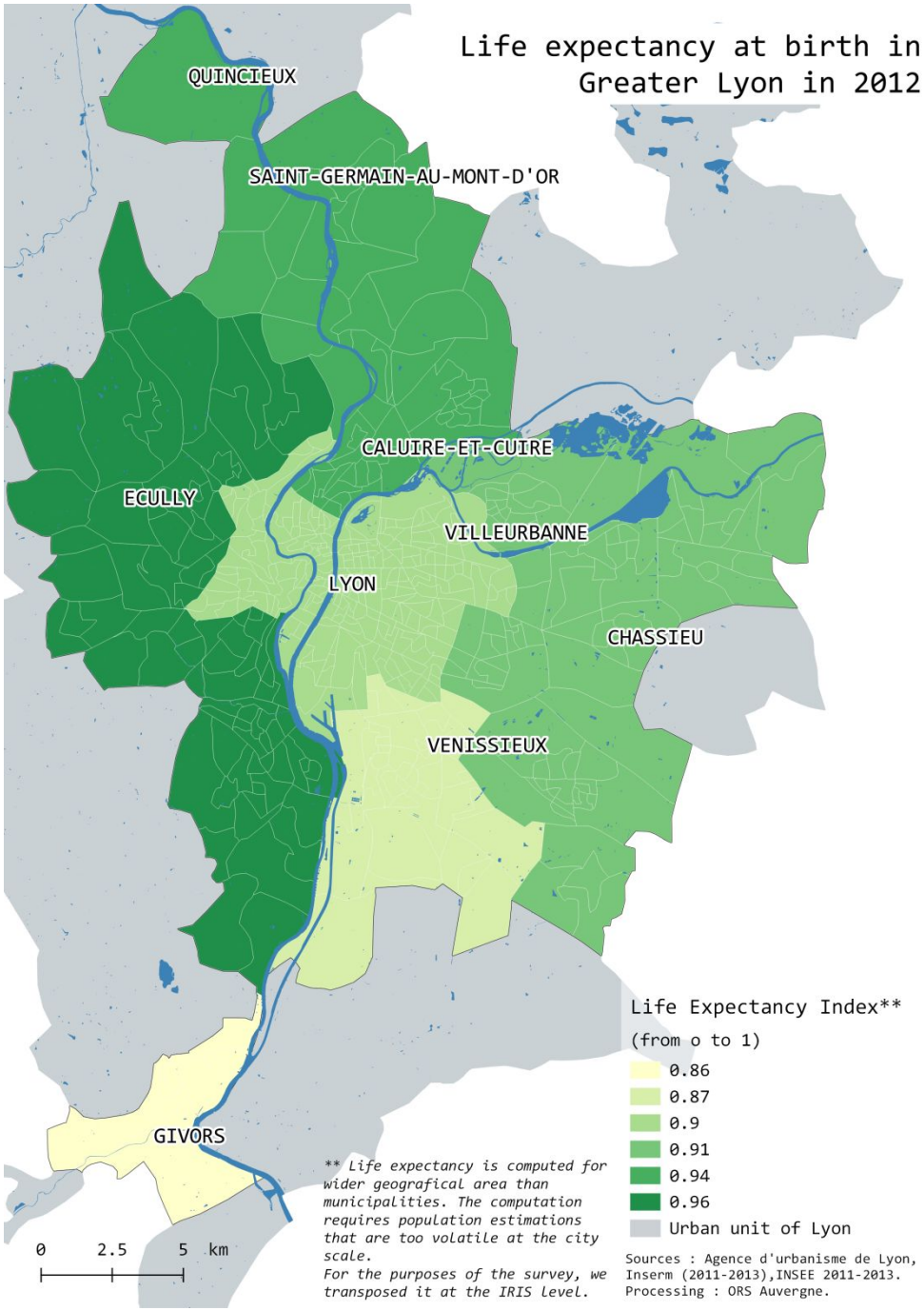
$$\frac{life\ expectancy - 65}{85 - 65}$$

IDH2- computed by Greater Lyon agency

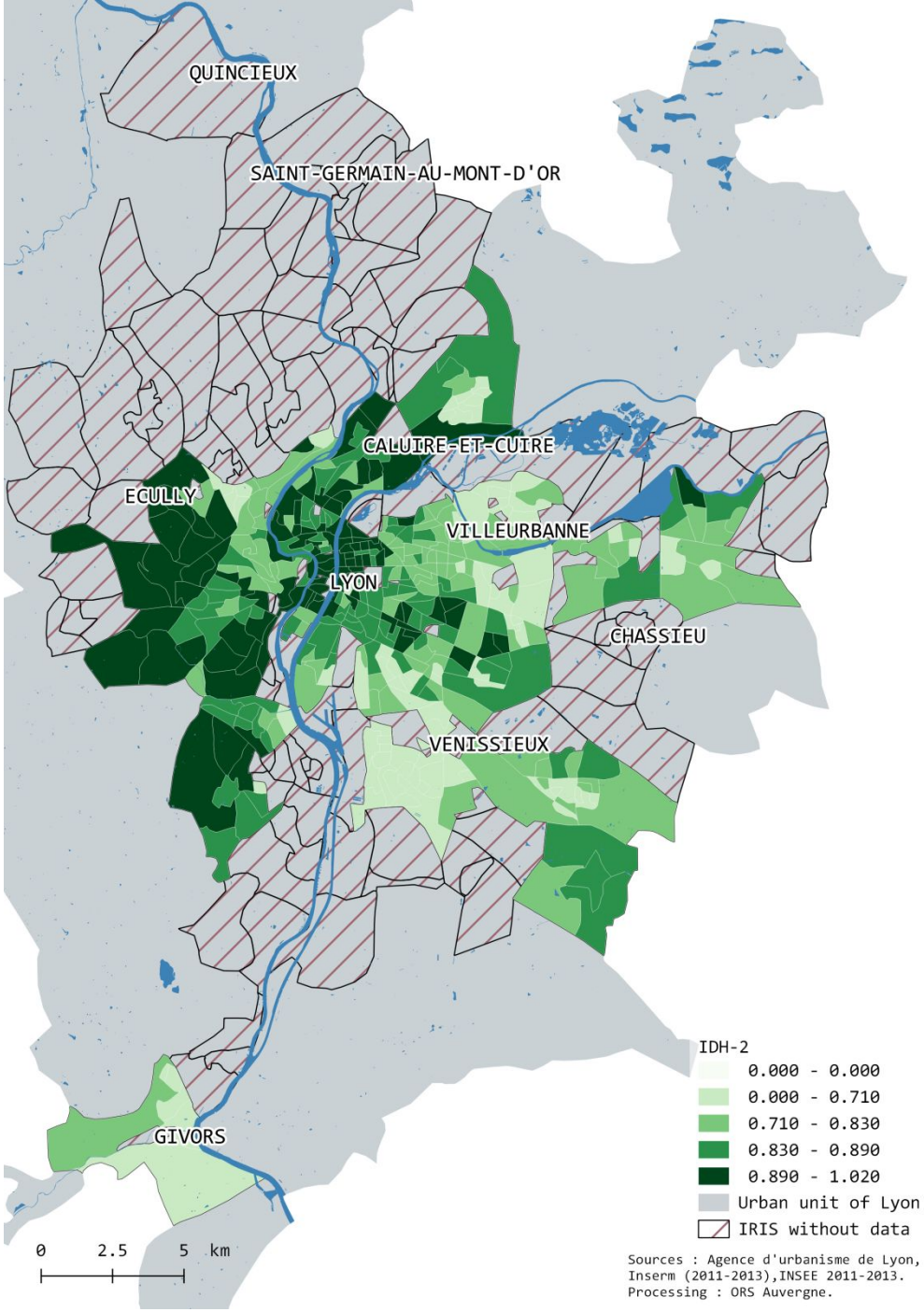


Focus on Lyon and London

Data	Lyon	London
Longevity	Moyenne de l'espérance de vie à la naissance (H/F) Disponible par grands secteurs. UrbaLyon	Life expectancy at birth (ward level) https://data.london.gov.uk/dataset/life-expectancy-birth-and-age-65-ward
Education (Adult)		16 or under with full time education completed / Total population (2008 - 2014).
Income	Médiane des revenus fiscaux des ménages par unité de consommation (en €. traduit en dollars US et en parité de pouvoir d'achat) https://www.insee.fr/fr/statistiques/1895078#dictionnaire (Revenus et pauvreté des ménages en 2012Dispositif Fichier localisé social et fiscal (Filosofi))	Mean and median average gross annual household income for. Lower SOAs. Middle SOAs. Wards and Boroughs. London. 2001/02 to 2012/13. https://data.london.gov.uk/dataset/household-income-estimates-small-areas


Life expectancy at birth in Greater Lyon in 2012
QUINCIEUX
SAINT-GERMAIN-AU-MONT-D'OR
CALUIRE-ET-CUIRE
ECULLY
VILLEURBANNE
LYON
CHASSIEU
VENISSIEUX
GIVORS
0 2.5 5 km
** Life expectancy is computed for wider geografical area than municipalities. The computation requires population estimations that are too volatile at the city scale.
For the purposes of the survey, we transposed it at the IRIS level.
Life Expectancy Index**
(from o to 1)
0.86
0.87
0.9
0.91
0.94
0.96
Urban unit of Lyon
Sources : Agence d'urbanisme de Lyon, Inserm (2011-2013),INSEE 2011-2013.
Processing : ORS Auvergne.

IDH-2 for Iris in Greater Lyon



OTHER SOCIO-SPATIAL APPROACH IN LYON & LONDON

Data

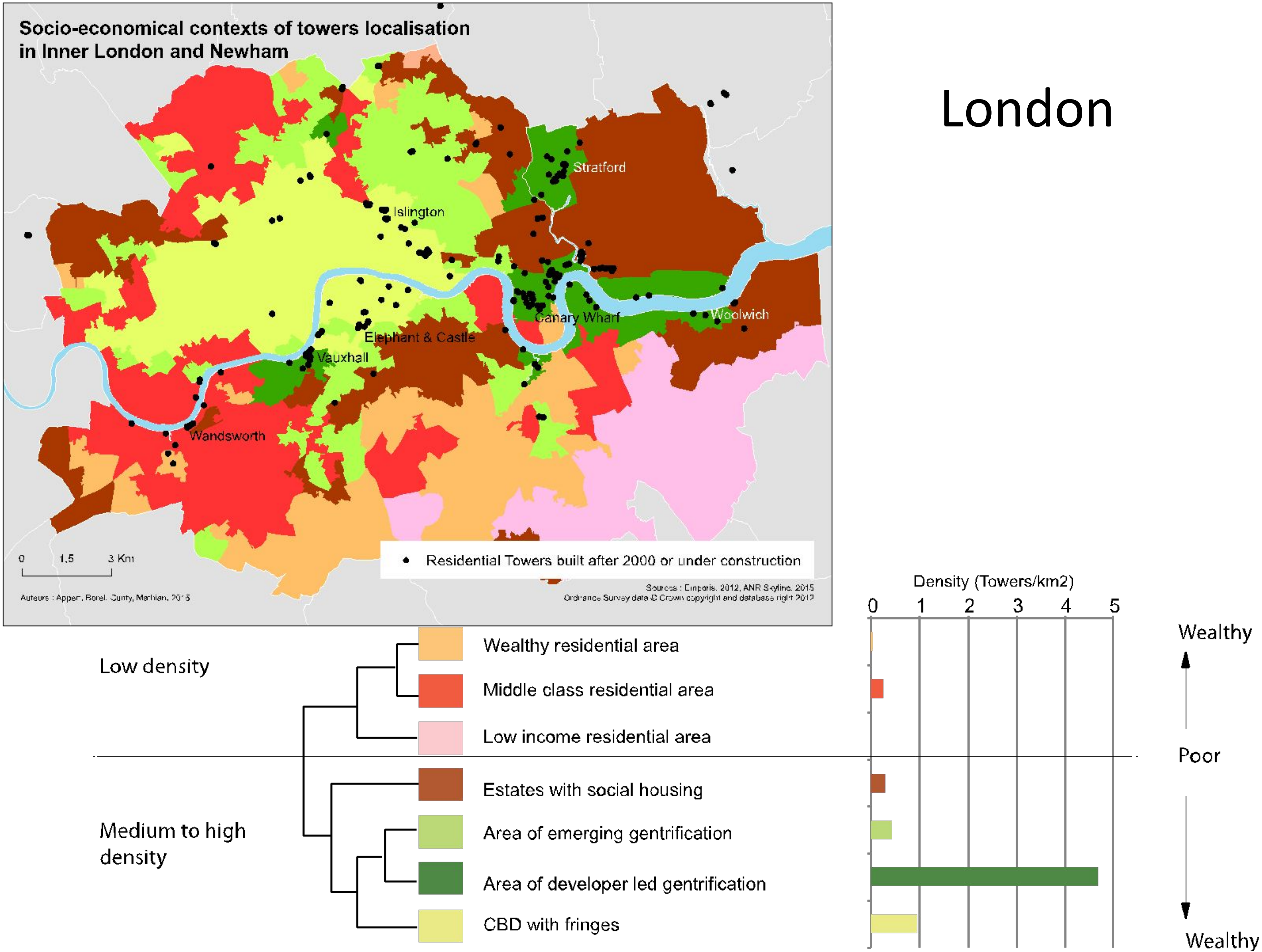
6 dimensions about population

- demography
- Social composition
- Housing
- Mobility (effective and potential)
- Accessibility
- Housing Market

Data

Dimension	Description	London	Lyon
Demography	The olrder (>60 ans), the younger (<20)	X	X
Demography	Family composition (1P, more)	X	X
Employment	Occupied, unemployed	X	X
Social	Socio-professional categories (high/int/low),	X	X
Mobility	Without car, using public transport/ car for work	X	X
Mobility	Living and working in the same community	X	X
Housing	Overcrowding housing, underdensified	X	X
Housing	Housing occupied by owner, Social housing	X	X
Housing	Housing built before 1946, after ???	-	X
Housing Market	Prices (sell) / income	X	Soon !!
Accessibility	Global accessibility (centre, amenities, transport…)	X	-

London



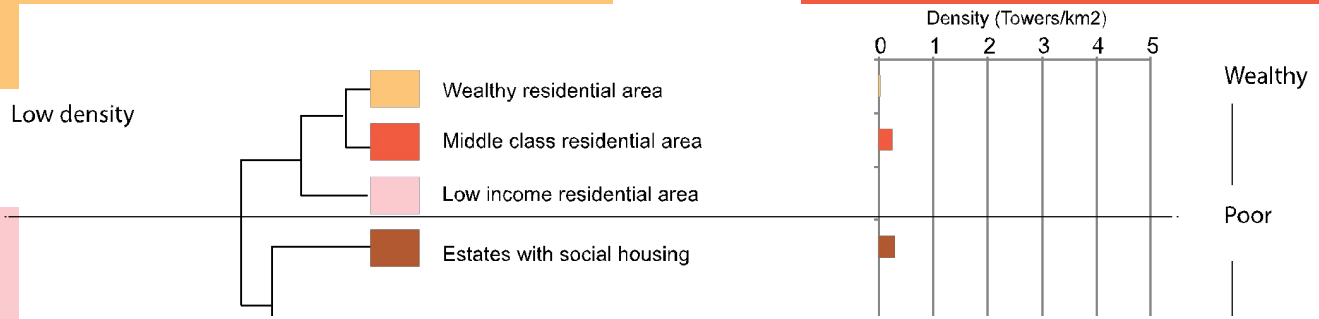
Socio-economical contexts of towers localisation in Inner London and Newham
Stratford
Islington
Canary Wharf
Woolwich
Elephant & Castle
Vauxhall
Wandsworth
0 1,5 3 Km
Residential Towers built after 2000 or under construction
Sources : Emporis, 2012, ANR Skyline, 2015
Ordnance Survey data © Crown copyright and database right 2012
Auteurs : Appert, Borel, Cunty, Mathian, 2015
Low density
Wealthy residential area
Middle class residential area
Low income residential area
Medium to high density
Estates with social housing
Area of emerging gentrification
Area of developer led gentrification
CBD with fringes
Density (Towers/km2)
0 1 2 3 4 5
Wealthy
Poor
Wealthy

Dulwich College

www.openplay.co.uk

Catford

http://www.shutterstock.com/



Eltham

www.robinson-jackson.com

ylesbury Estate

fightfortheaylesbury.wordpress.com

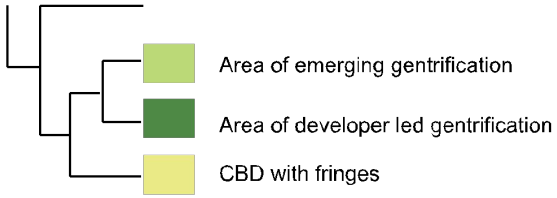
rixton

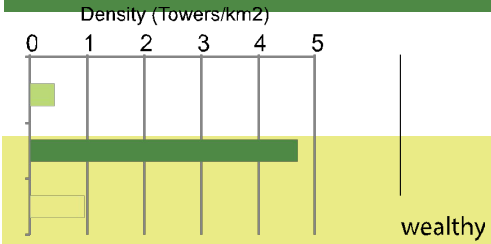
tp://www.urban75.org/

Greenwich Peninsula

http://www.knightdragon.com/greenwich-peninsula/timeline

Medium to high density

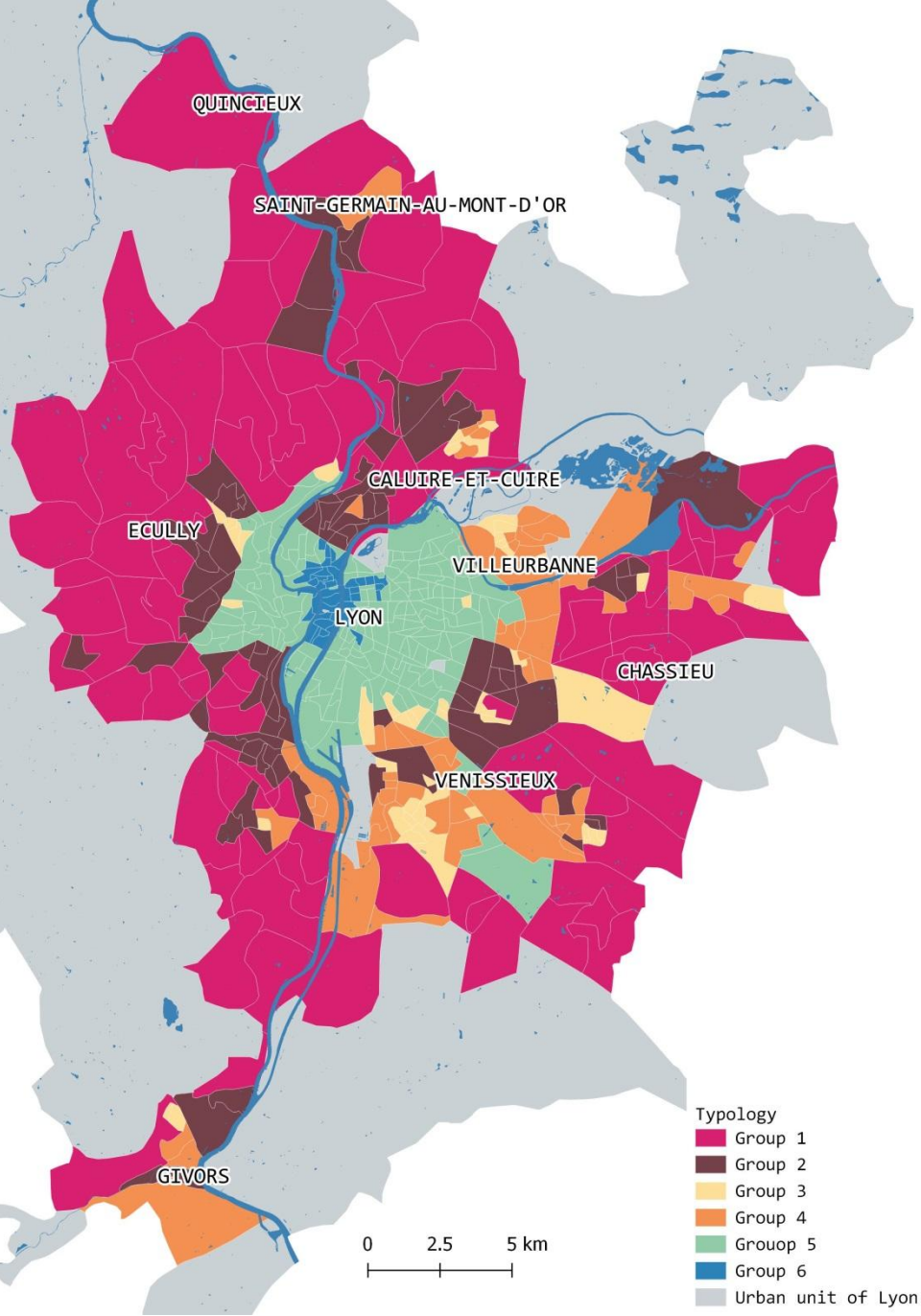




The city

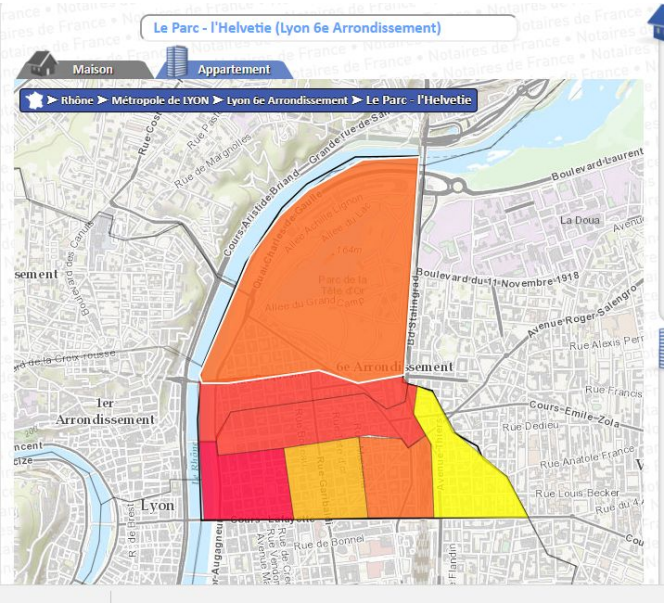
M. Appert, 2013

First results for Lyon



Work in progress

Housing prices: exploration



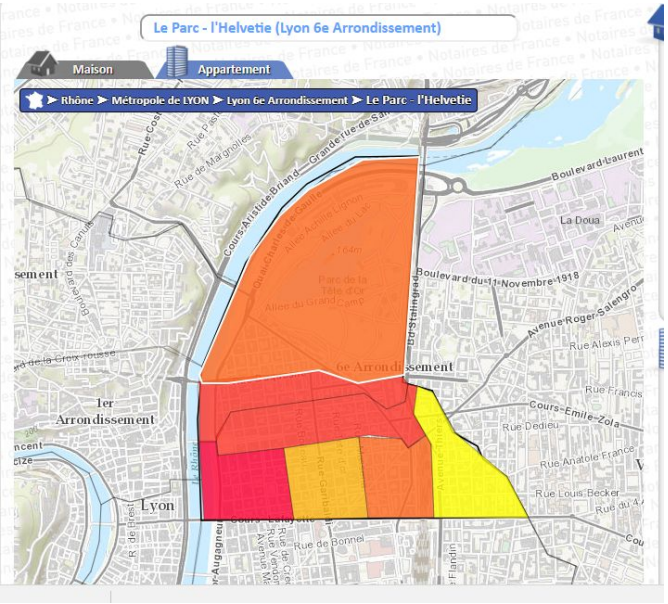
- Selling => « BIENS » DB= notary federation / VERY EXPENSIVE

 https://barometre.immobilier.notaires.fr/appartements-anciens/departement/rhone/69/commune/lyon-6e-arrondissement/69386/quartier/charmettes---bellecombe/6938607

- Data are mapped at a geographical level which correspond to agregation of IRIS

It may be used to validate webscraping of « seloger.com » and « airbnb »

Housing prices: exploration



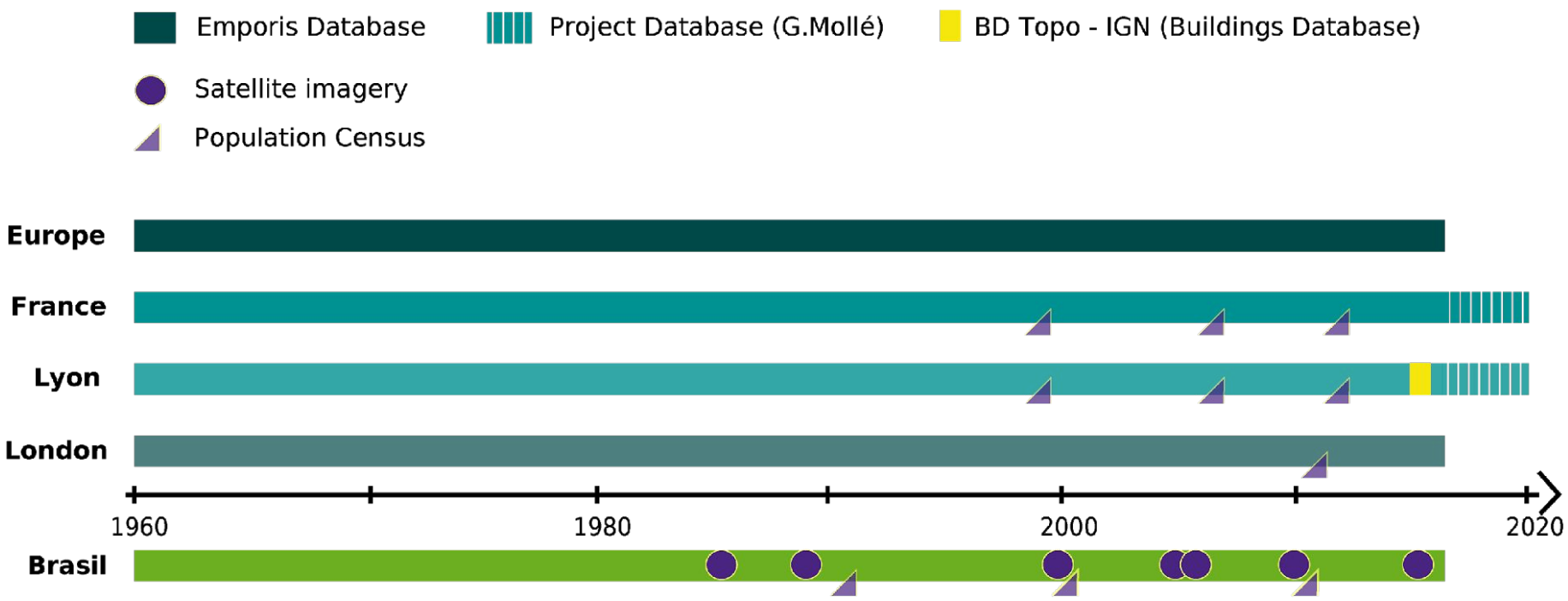
- Selling => « BIENS » DB= notary federation / VERY EXPENSIVE

 https://barometre.immobilier.notaires.fr/appartements-anciens/departement/rhone/69/commune/lyon-6e-arrondissement/69386/quartier/charmettes---bellecombe/6938607

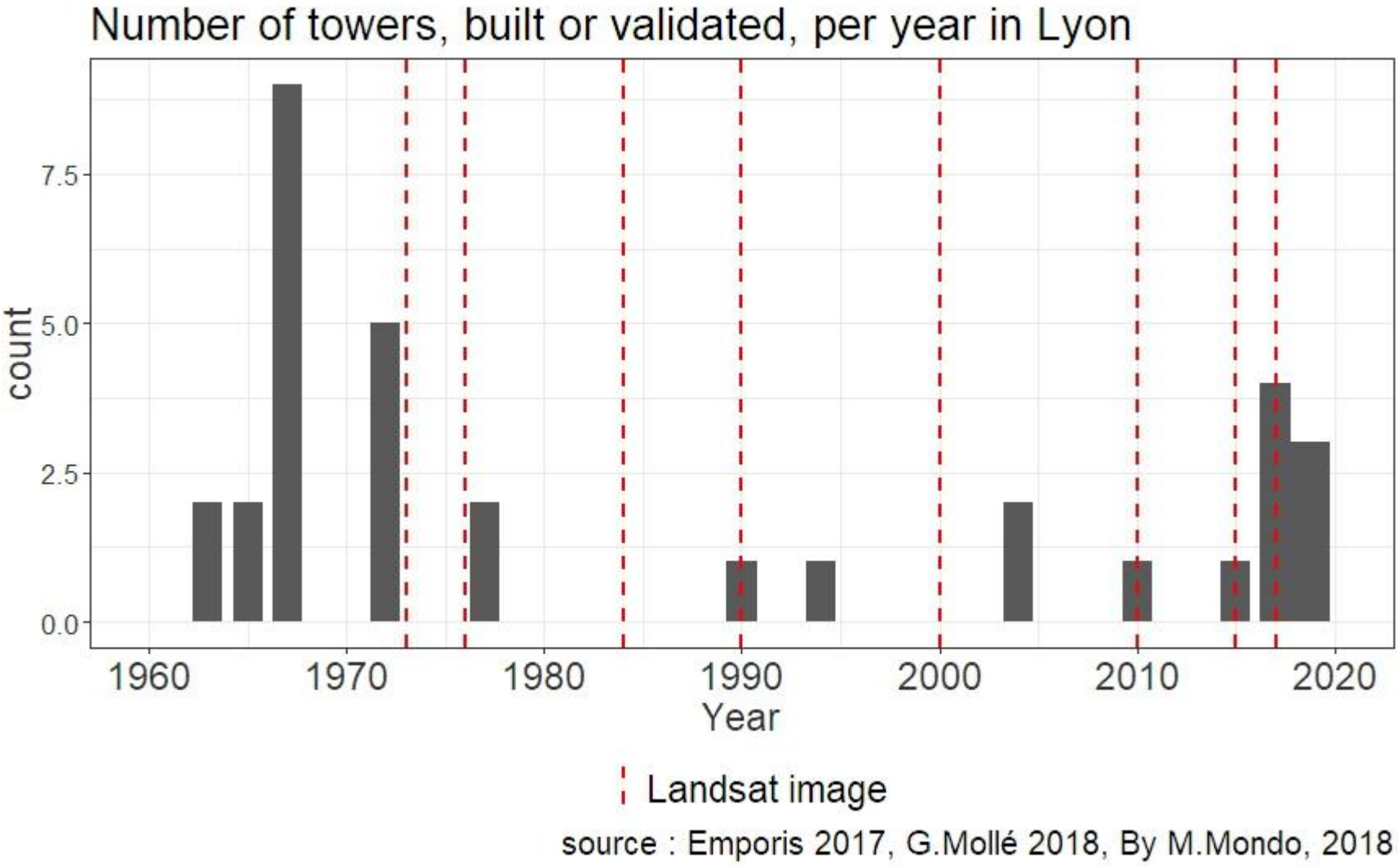
 Rent => https://www.observatoires-des-loyers.org/niveau-des-loyers.htm#ci=69123&ca=L6900&address=69000+Lyon&type_loyer=stock

SATTELITE IMAGES

HIGHRISE :
An overview of data's availability



Available Sattelite images according to « *verticalisation process* » in Lyon



Date	LANDSAT-ProductID	Satellite	Year	Resolution	Bands
21/03/1973	LM12120281973080AAA04	Landsat1 – MSS	1973	60	Green, Red, Near Infrared, Near Infrared
01/04/1990	LT05_L1TP_197028_19900401_20180216_01_T1	Landsat5-TM	1990	30	Blue, Green, Red, NIR, SWIR 1, Thermal, SWIR 2
08/06/2000	LT05_L1TP_196028_20000608_20180312_01_T1	Landsat5-TM	2000	30	Blue, Green, Red, NIR, SWIR 1, Thermal, SWIR 2
07/08/2010	LT05_L1TP_196028_20100807_20180128_01_T2	Landsat5-TM	2010	30	Blue, Green, Red, NIR, SWIR 1, Thermal, SWIR 2
16/07/2017	LC08_L1TP_197028_20170716_20170727_01_T1	Landsat8-OLI	2017	30	Blue, Green, Red, NIR, SWIR 1, Thermal, SWIR 2

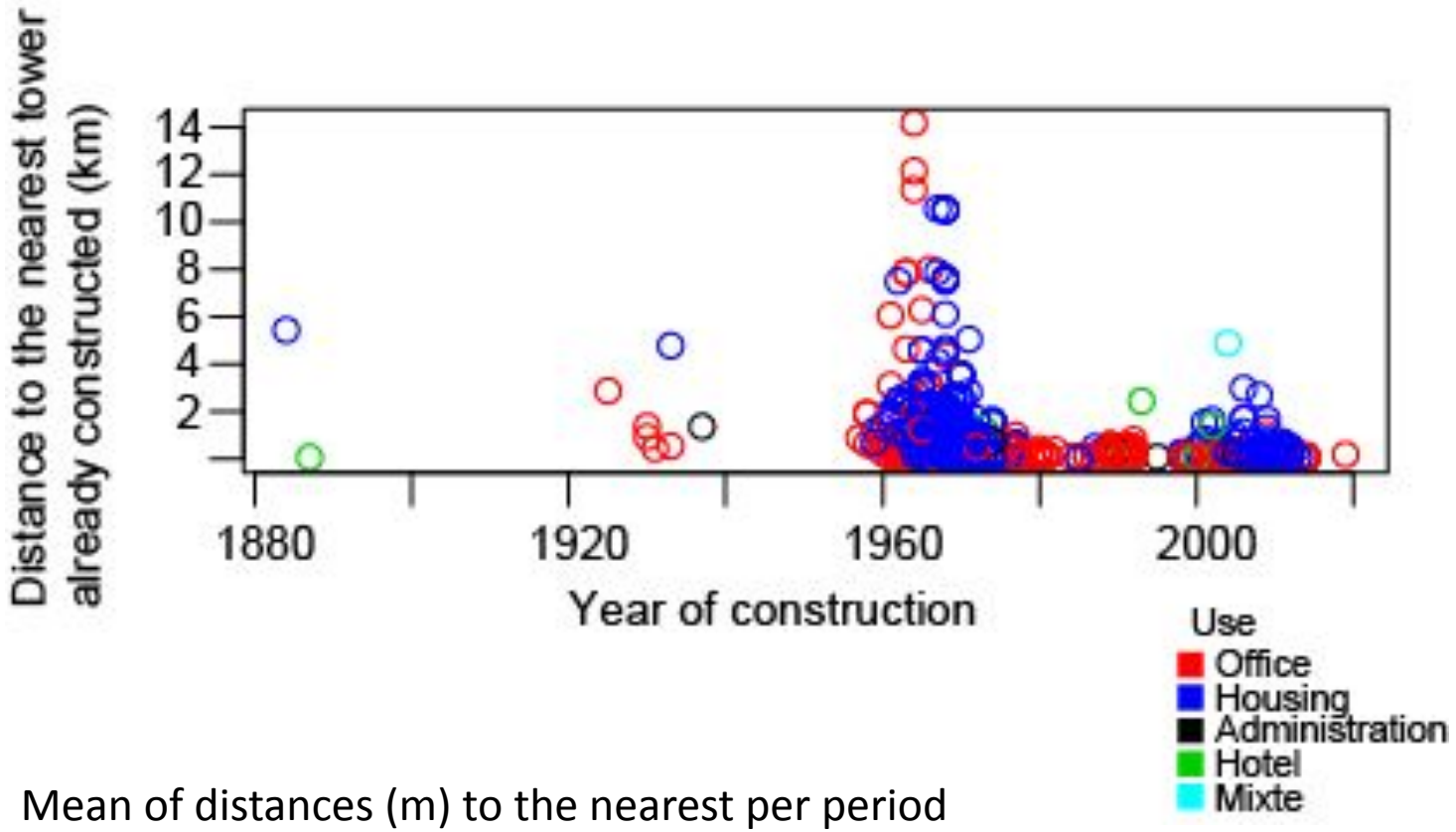
1- Cluster Analysis

2- Morphological analysis

OTHERS ANALYSIS

The localisation logic

- Different choices of localization:
  - towards a tightening



Mean of distances (m) to the nearest per period

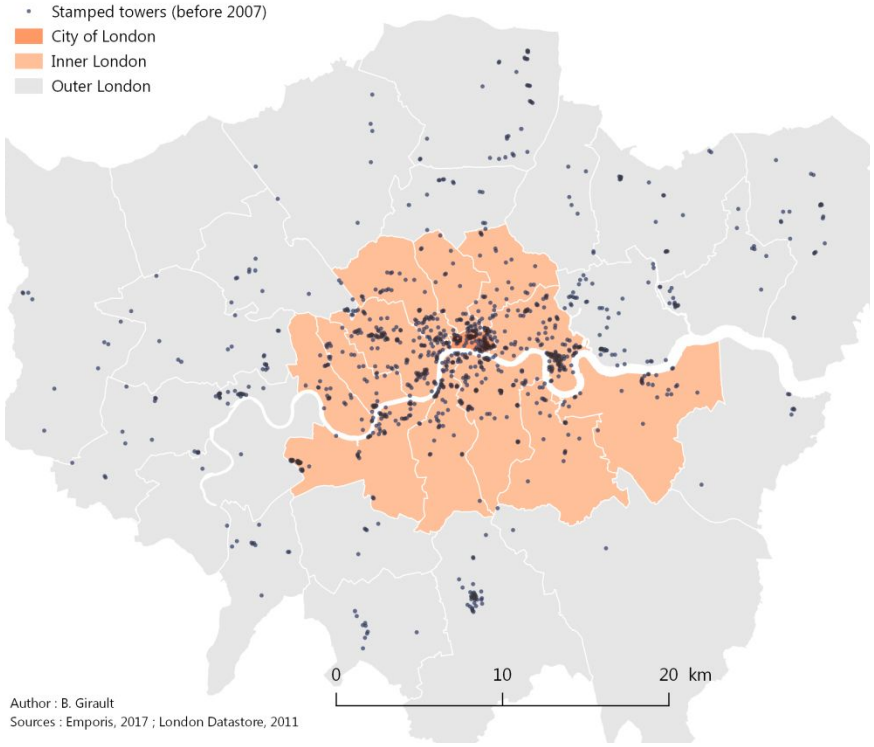
1960-1970	1970-1980	1980-1990	1990-2000	2000-2010	After 2010
1600	*470*	*210*	*500*	*375*	*160*

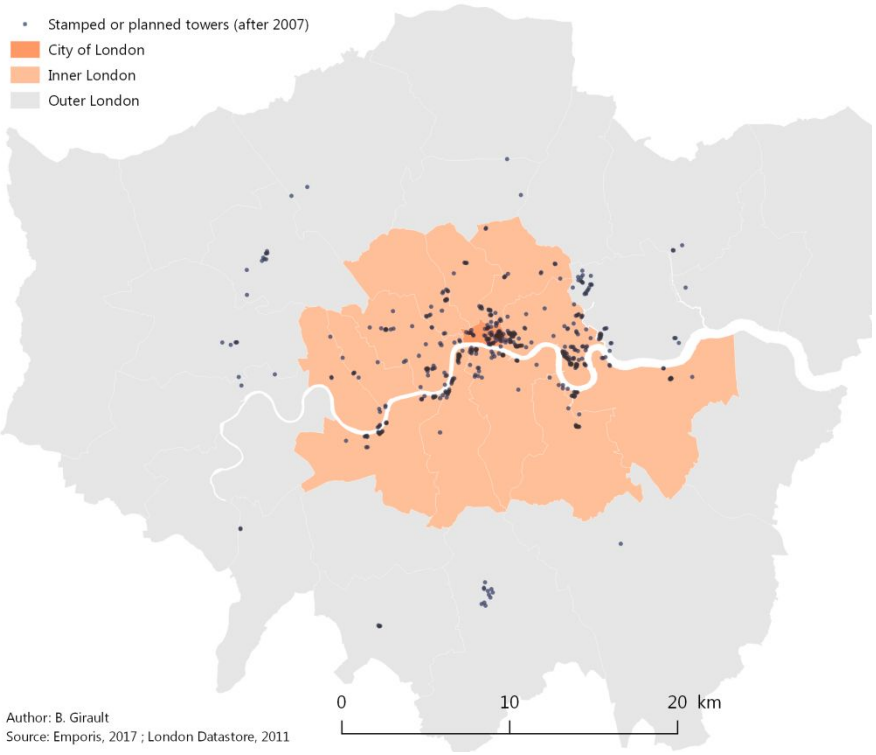
Tours Emporis (before et after 2007)

- 1616 towers / 2288 (total Emporis)

Before 2007 : 1124 towers

After 2007 : 492 towers



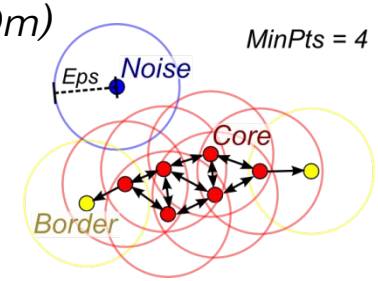


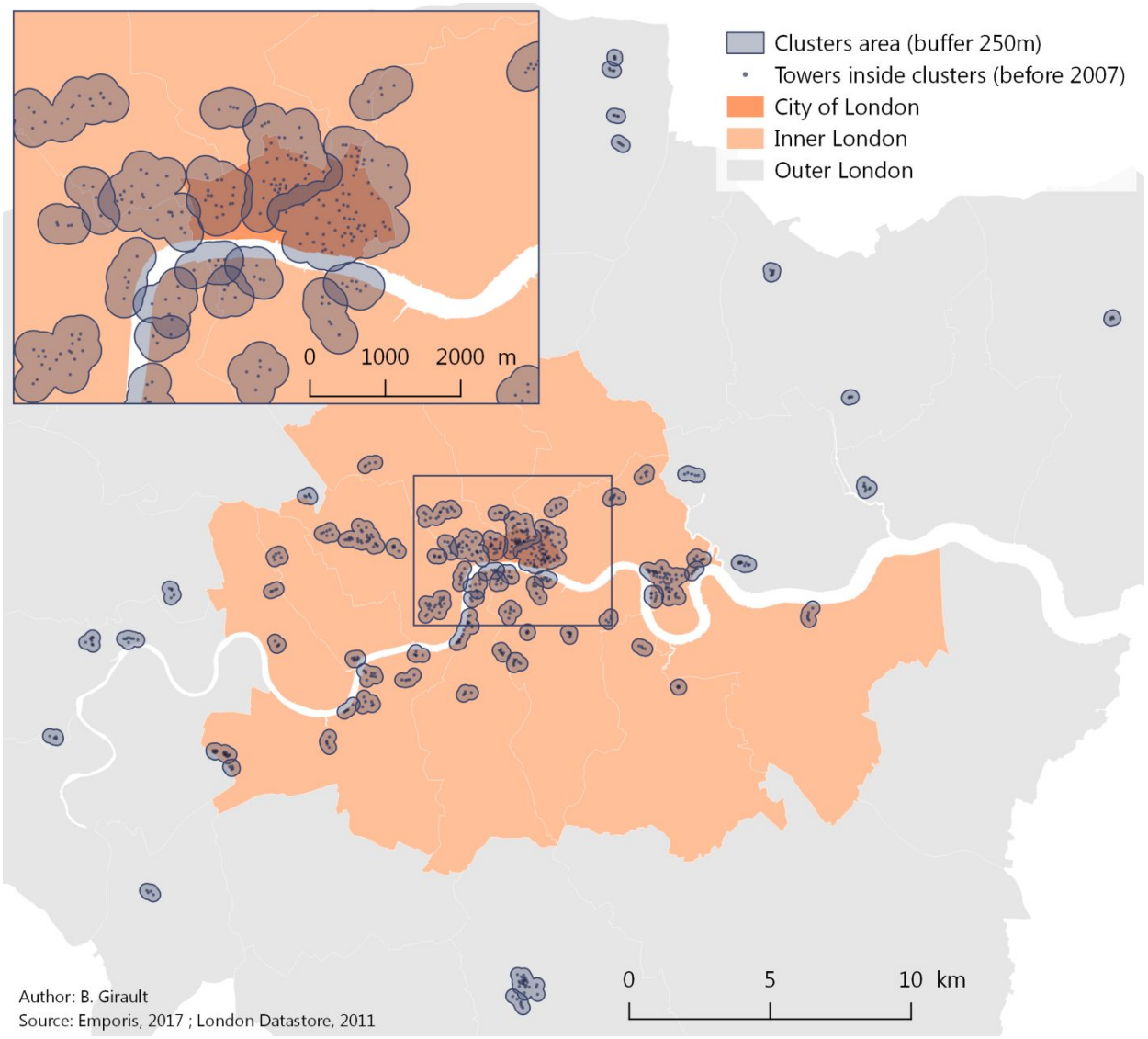
Which logic of towers'concentration

Spatial clusters before 2007

69 clusters

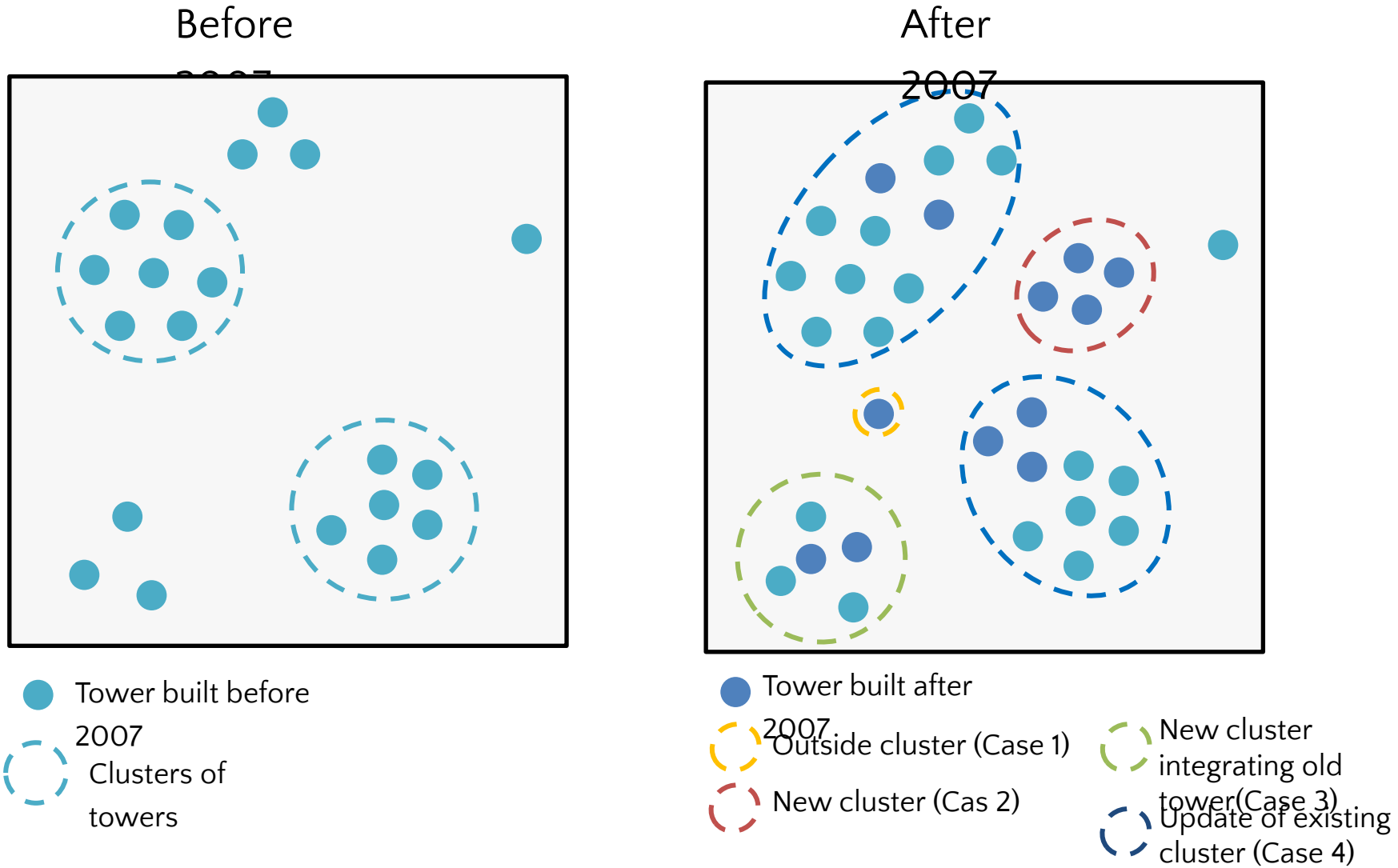
db_Scan (4 tours, Eps = 250m)





db_Scan (4 tours, Eps = 250m)

Different theoritical cases of evolution

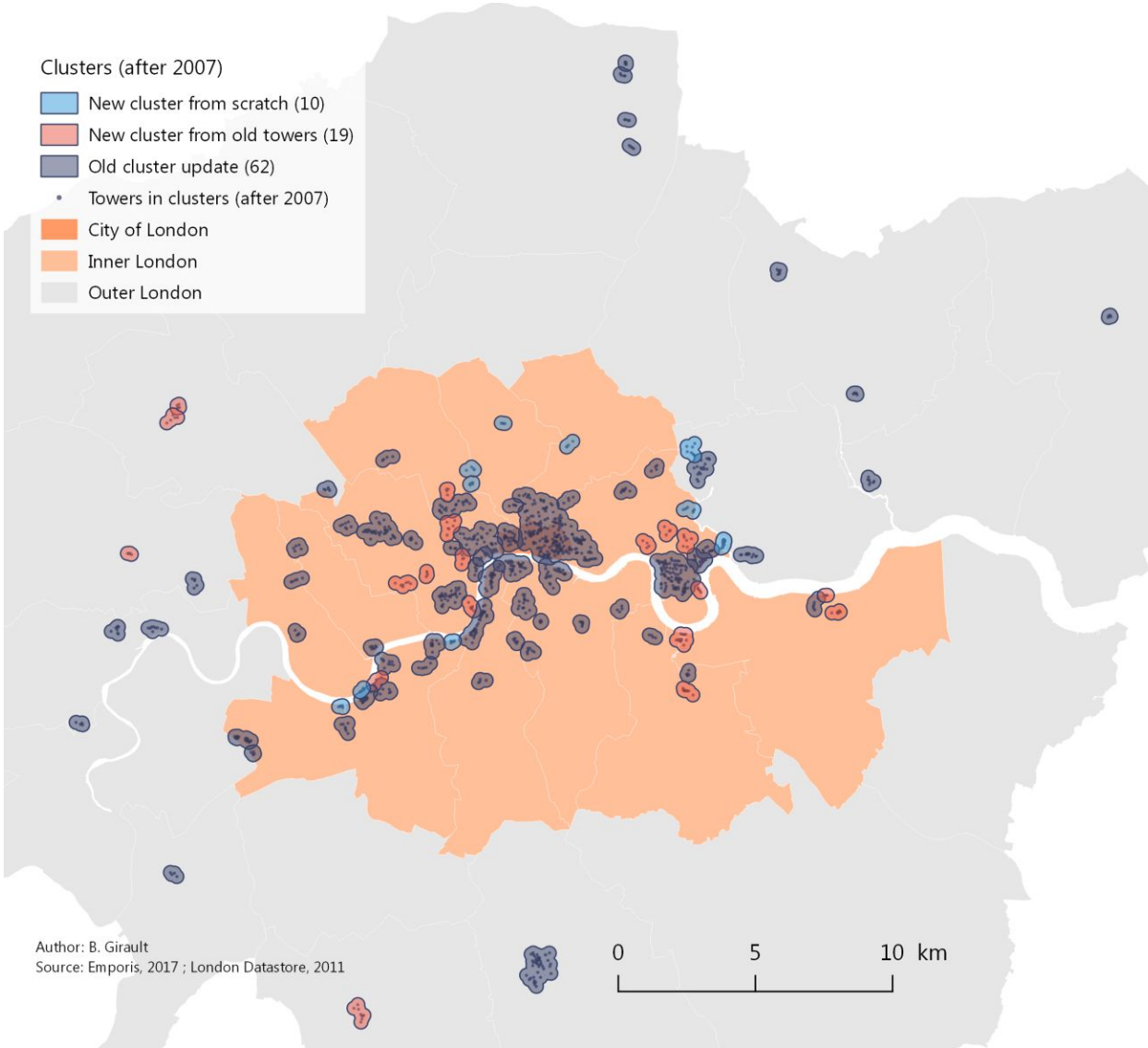


London type of towers' concentration after 2007

Evolution of the clusters (before/ after 2007)

91 clusters

- 10 new clusters
- 19 from existing towers
- 7 fusion of clusters



Morphological caracterisation of the neighbouring context of the tower

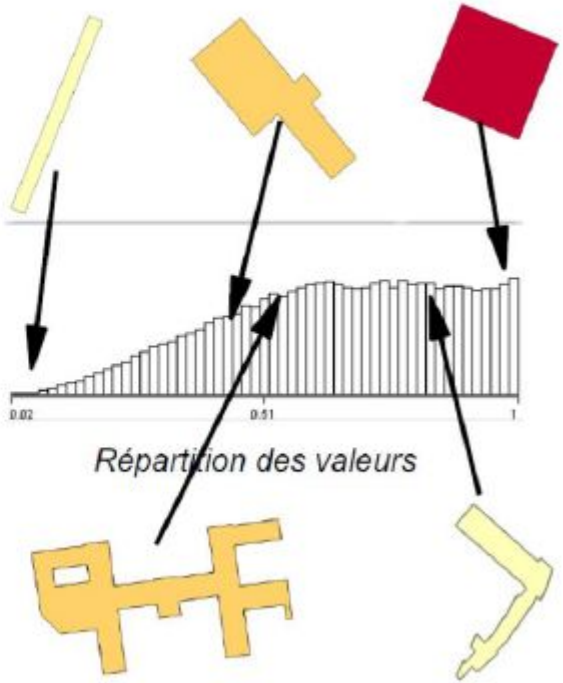
Is that possible to describe the built up morphology at the level of territorial units?

In order to study the different morphological urban context of the towers implantation.

Explorations (Jimmy Chamberland IGN-COGIT)

- Different indexes= elongation

-> Smallest Minimum Bounding Rectangle

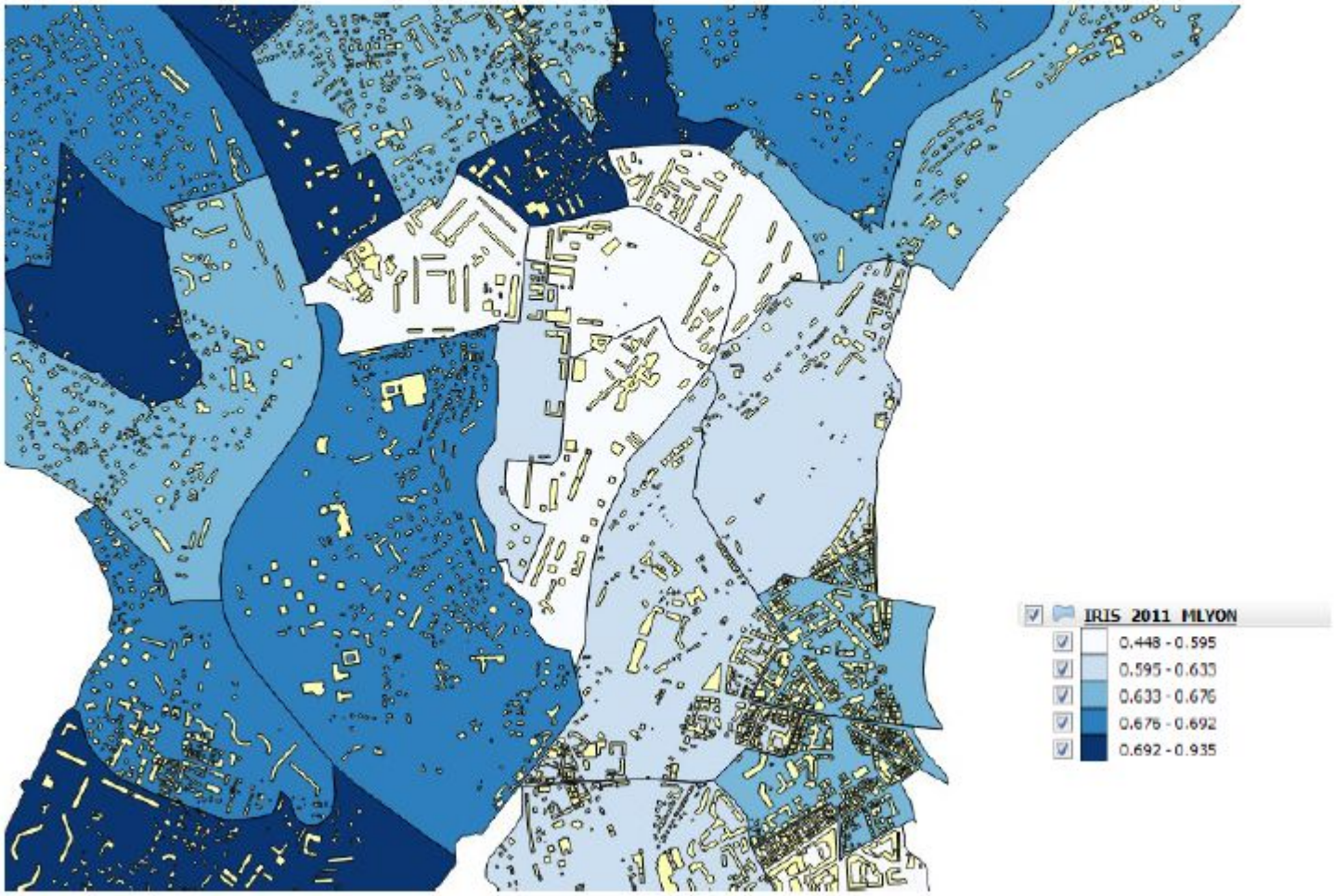


Catégorie	NomTable	Caractéristique	Intitulé de l'indicateur	Donnée	Niveau	Complexité	Priorité	Référence
Forme	Convexity1	diversité des formes	Convexité par rapport au SMBR	2D	bâtiment			Tidy City
Forme	Convexity2	diversité des formes	Convexité par rappport à l'enveloppe convexe	2D	bâtiment			Tidy City
Forme	Elongation	diversité des formes, intégration	Elongation	2D	bâtiment	1	1	Vitor Silva, Conception et évaluation de prototype de simulation de la morphogénèse urbaine par agent vecteur multi-échelle
Forme	compactness	diversité des formes	Compacité	2D	bâtiment			Tidy City
Forme	area_per_p	indicateur de forme	Aire / périmètre	2D	îlot (peut aussi être appliqué à l'échelle du bâtiment)	0	1	N.Colannino, J.Roca Cladera, K. Pfeffer, An automatic classification of urban texture : form and compactness of morphological homogeneous structures in Barcelona
Forme	volume	indicateur de forme	volume	3D	bâtiment			
Forme	formFactor	diversit	Facteur de	3D	bâtiment	1	2	J.Ganitseva et V.Coors,

Catégorie	NomTable	Caractéristique	Intitulé de l'indicateur	Donnée	Niveau	Complexité	Priorité	Référence
		é des formes, intégration	forme= 2*H/aire SMBR					Automatic landmark detection for 3D urban models
Forme	complexity	diversité des formes, intégration	Complexité	2D	bâtiment	1	1	J.Ganitseva et V.Coors, Automatic landmark detection for 3D urban models
Forme	area	indicateur de forme, diversité des formes	Aire	2D	bâtiment, îlot	0	1	N.Colannino, J.Roca Cladera, K. Pfeffer, An automatic classification of urban texture : form and compactness of morphological homogeneous structures in Barcelona
Densité/Volume	densité du bâti 2D		Coefficient d'emprise au sol	2D	Zone	1	1	
Densité/Volume	Volume bâti 3D		Volume bâtie	3D	Zone	1	1	
Densité/Volume	végétation		Densité végétale	2D mais données pas forcément disponibles partout	Zone	1	1	
Densité/Volume	végétation		Coefficient d'occupation des sols végétaux	3D+	Zone	1	3	

From building to zone

La Duchère : élongation - médiane



Indexes at the level of the zones

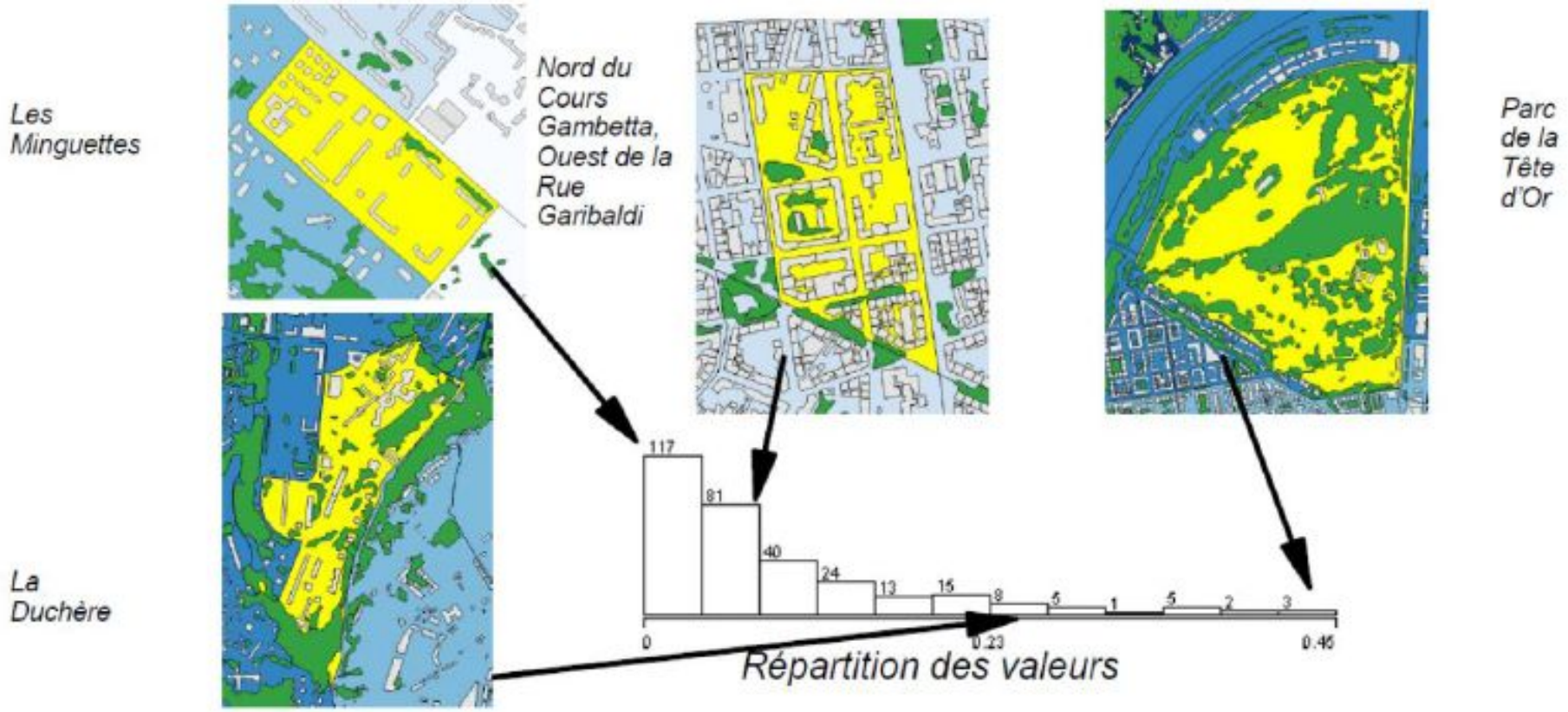
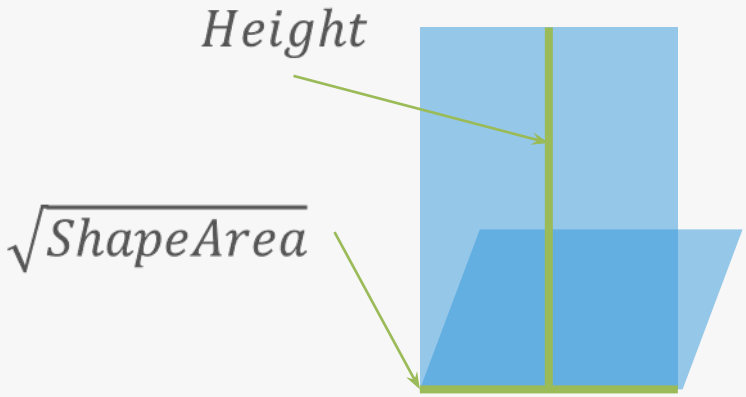


Figure 10 : Exemples de valeurs de densité végétale et positionnement de quelques IRIS par rapport à la répartition des valeurs prises issus d'une fiche que j'ai produite visant à illustrer les indicateurs du projet

Explorations for London and Lyon

- Verticalisations indexes

Building level



$$IsVerti = \frac{Height}{\sqrt{ShapeArea}}$$

If (IsVerti)>1 □ higher than wide

Statistical level

$$IsVertiRatio = \frac{\sum(IsVerti>1 \ \& \ Hmax>30}{NbBati}$$

$Hmax$ $Hmoy$

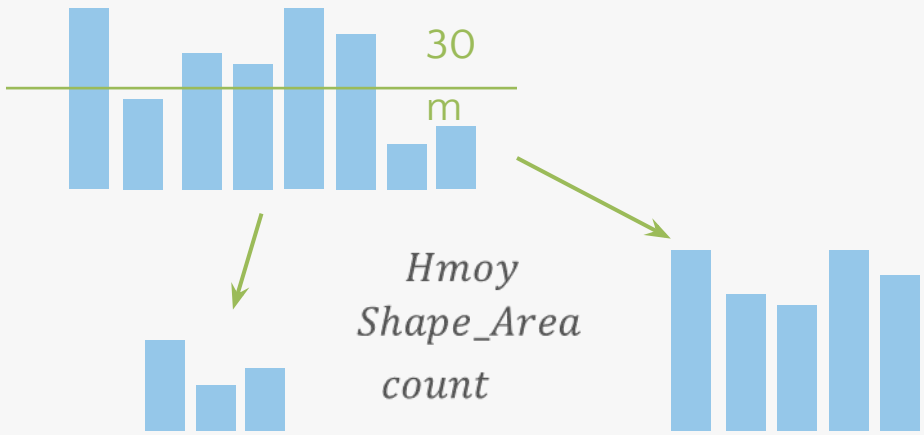
$$IsVertiMean = MEAN(IsVerti)$$

$$Hrel = \frac{Hmoy}{Hmax}$$

Explorations for London and Lyon

- Height index

$$\boldsymbol{Hrel30} = \frac{HmoyInf30}{HmoySup30}$$



$$\boldsymbol{RatioBati30} = \frac{COUNT(Bâti \geq 30)}{COUNT(Bâti)}$$

$$\boldsymbol{RatioSurf30} = \frac{Shape\_Area(Bâti \geq 30)}{Shape\_Area(Bâti)}$$

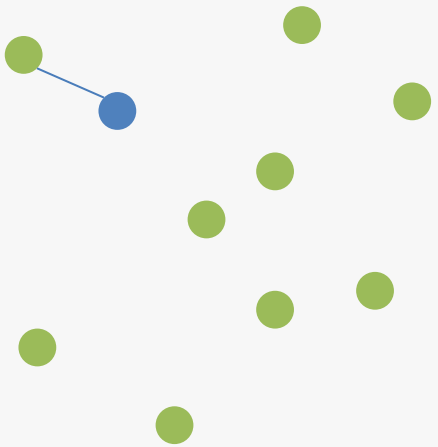
Explorations for London and Lyon

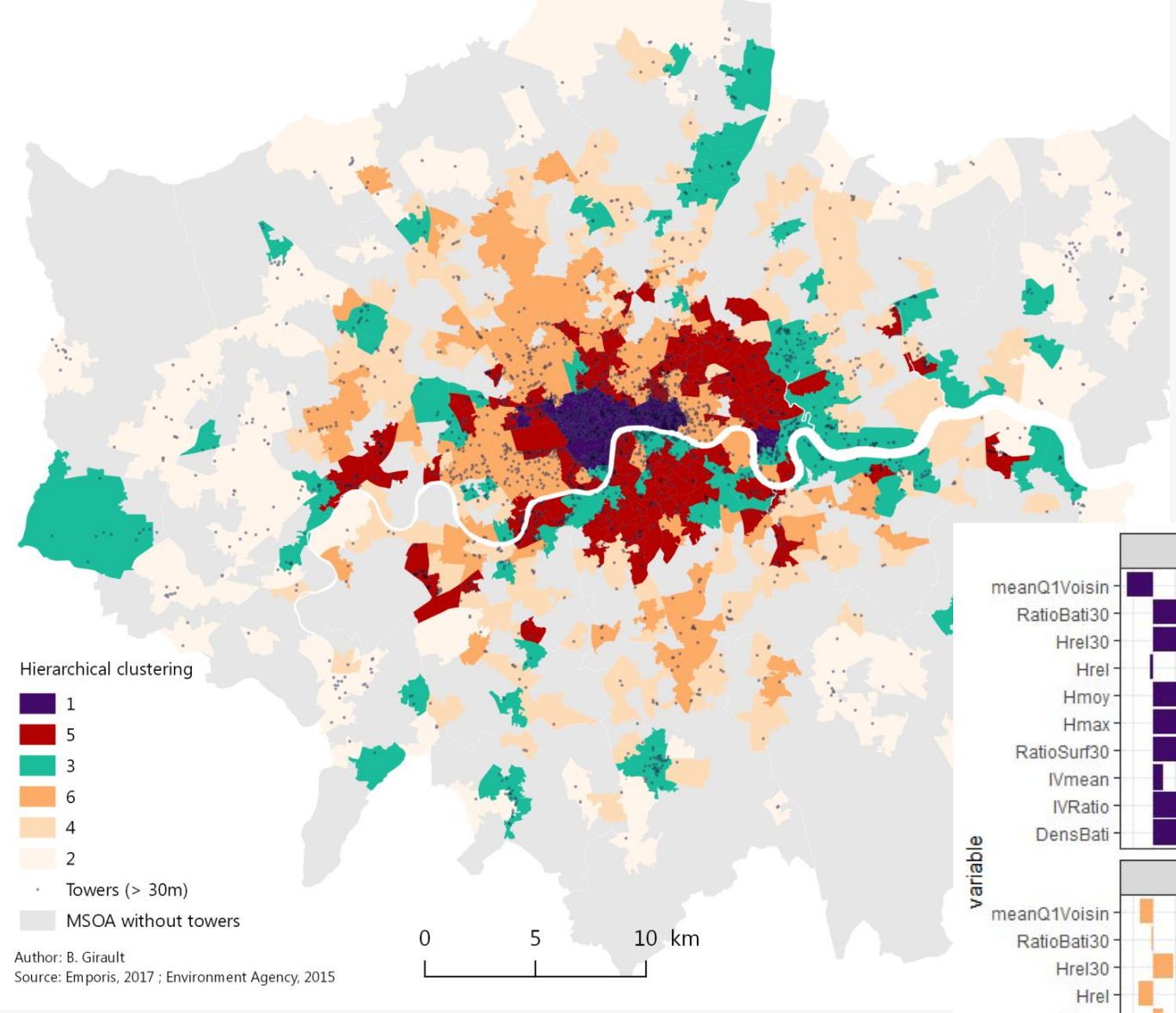
- Dispersion index

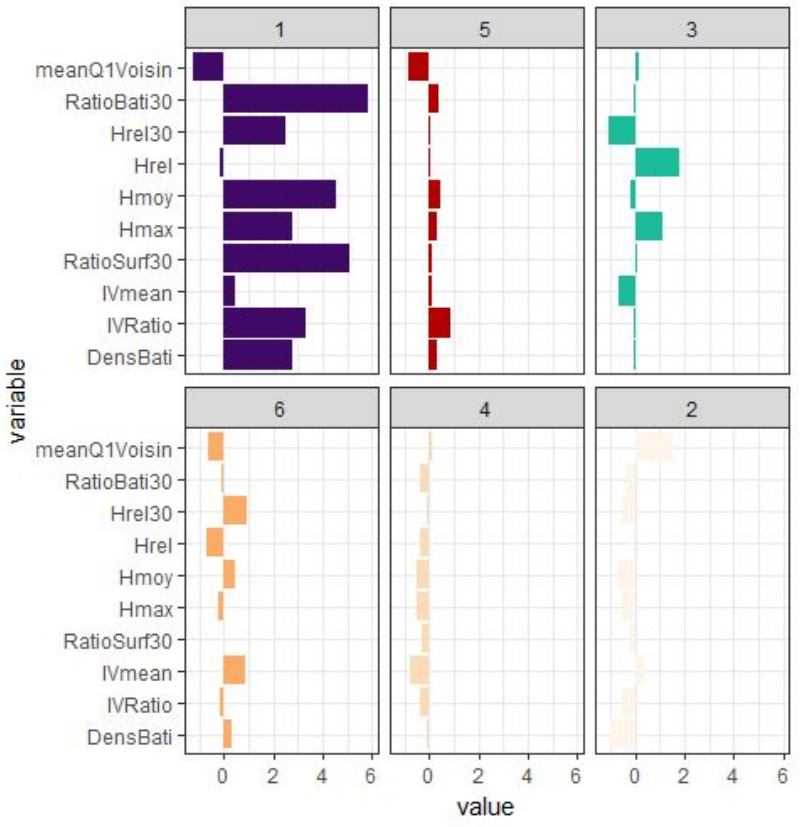
$$\boldsymbol{DensBati} = \frac{\sum ShapeArea(Bâti)}{Shape\_Area(IRIS|MSOA)}$$

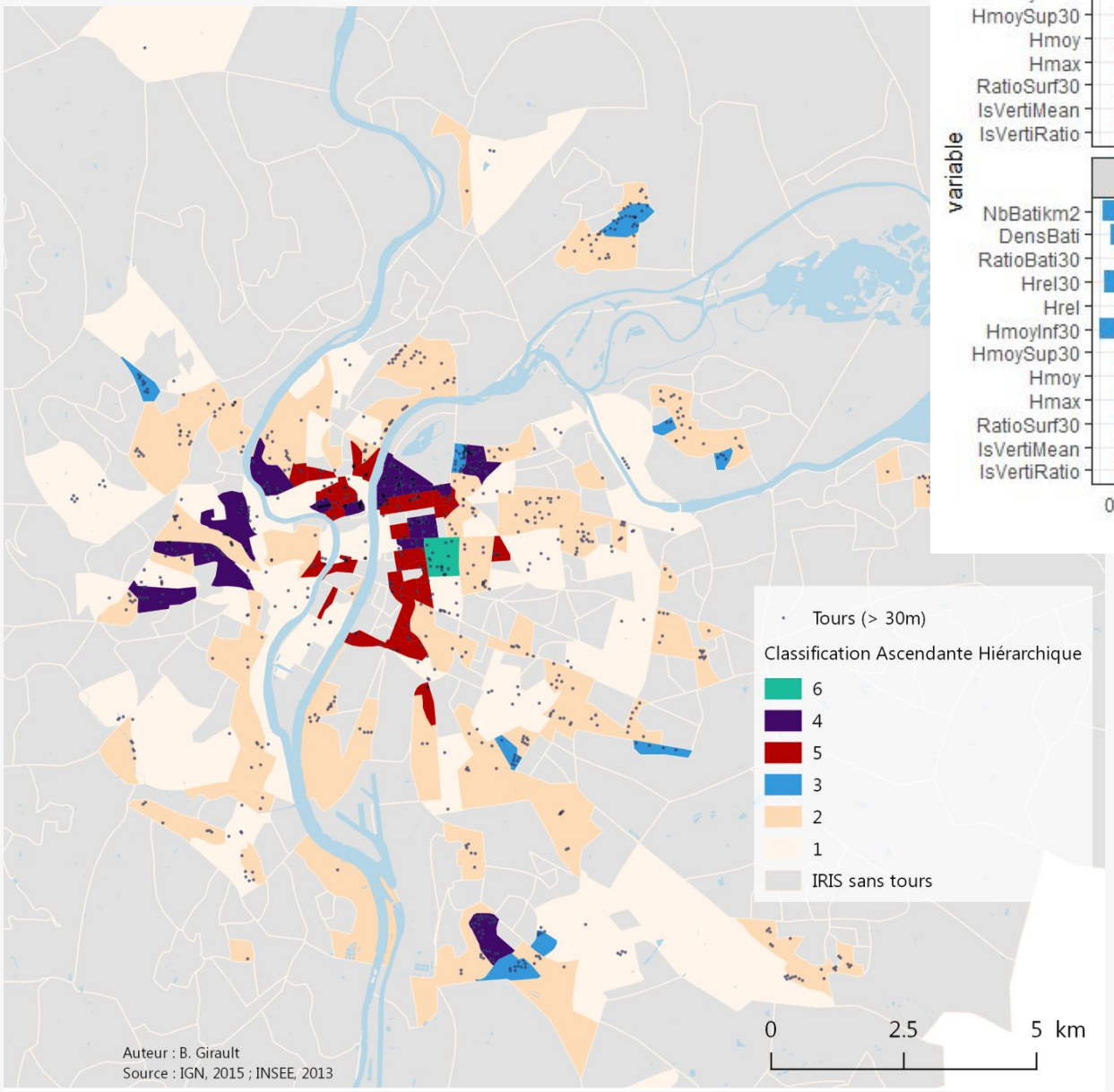
$$\boldsymbol{NbBatiKm2} = \frac{COUNT(Bâti)}{Shape\_Area/1\ 000\ 000}$$

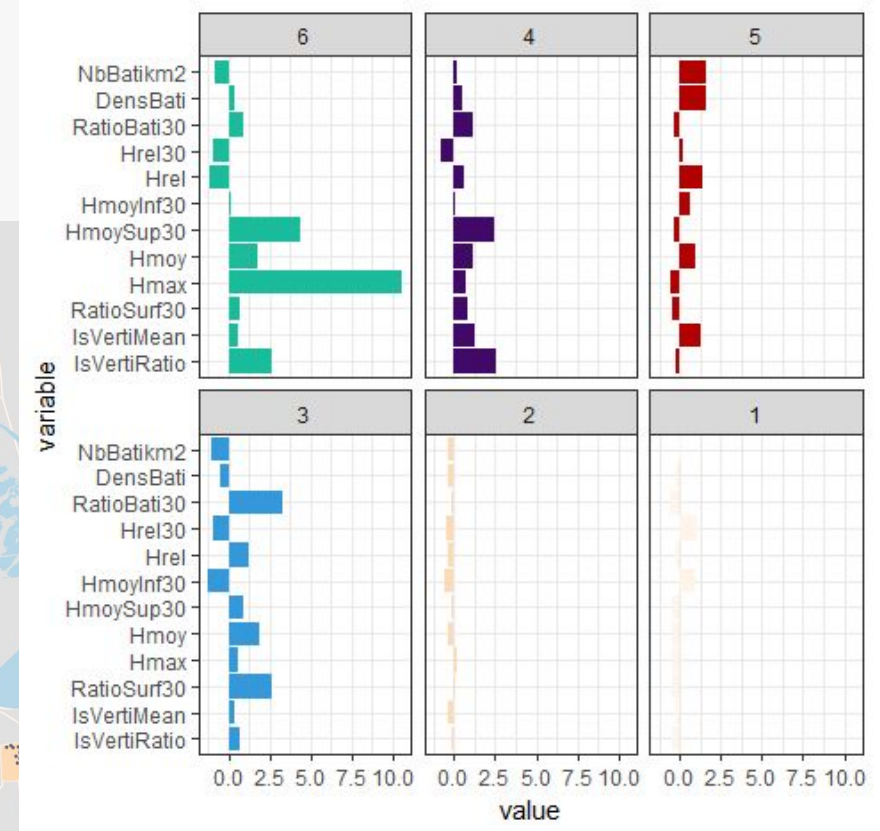
$$\boldsymbol{Q1NearestNeighbor} = Q1(DistanceNearestNeighbor)$$




Hierarchical clustering
1
5
3
6
4
2
Towers (> 30m)
MSOA without towers
0
5
10 km
Author: B. Girault
Source: Emporis, 2017 ; Environment Agency, 2015

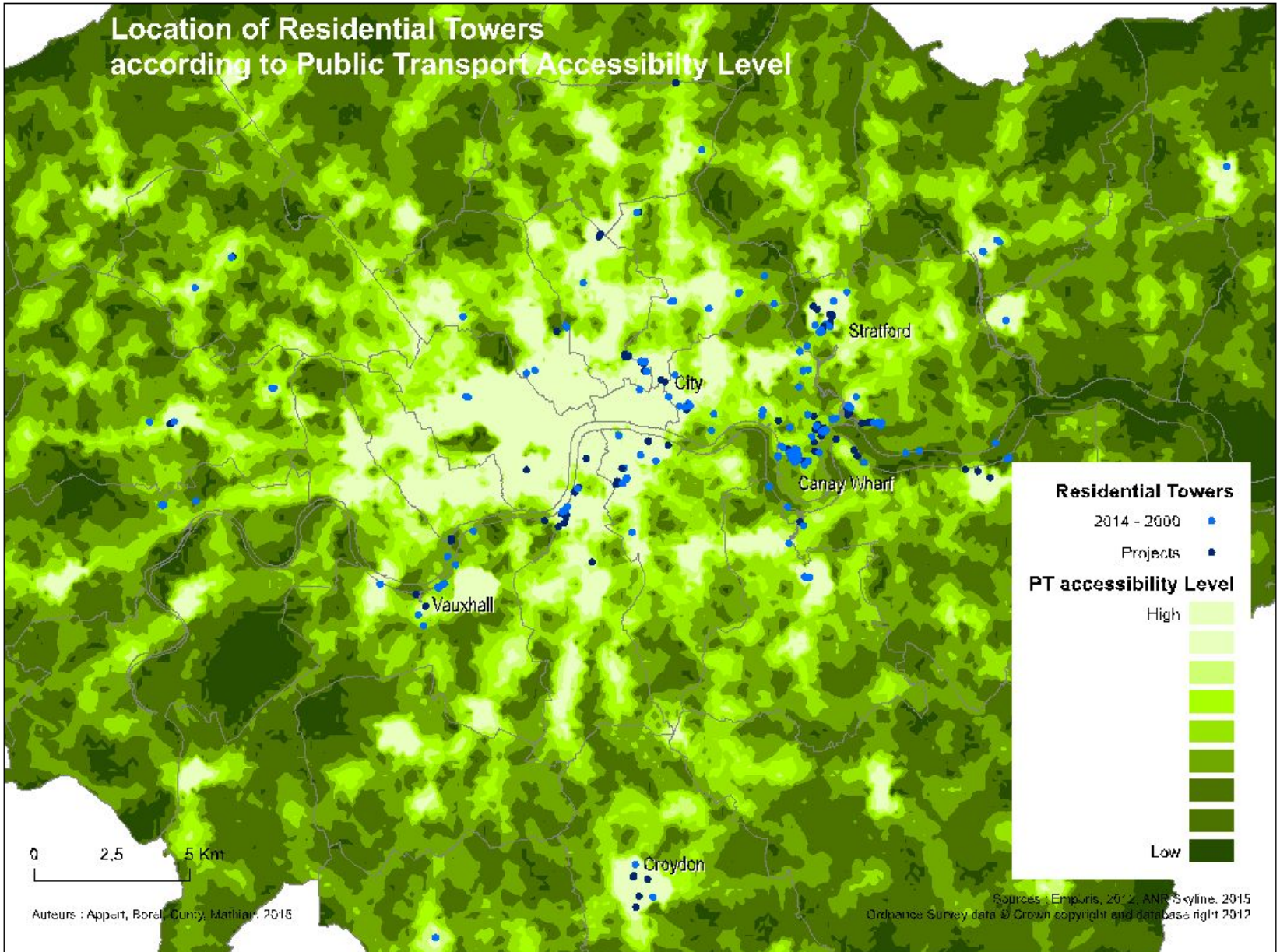

1
5
3
6
4
2
meanQ1Voisin
RatioBati30
Hrel30
Hrel
Hmoy
Hmax
RatioSurf30
IVmean
IVRatio
DensBati
variable
0
2
4
6
value


Tours (> 30m)
Classification Ascendante Hiérarchique
6
4
5
3
2
1
IRIS sans tours
0
2.5
5 km
Auteur : B. Girault
Source : IGN, 2015 ; INSEE, 2013

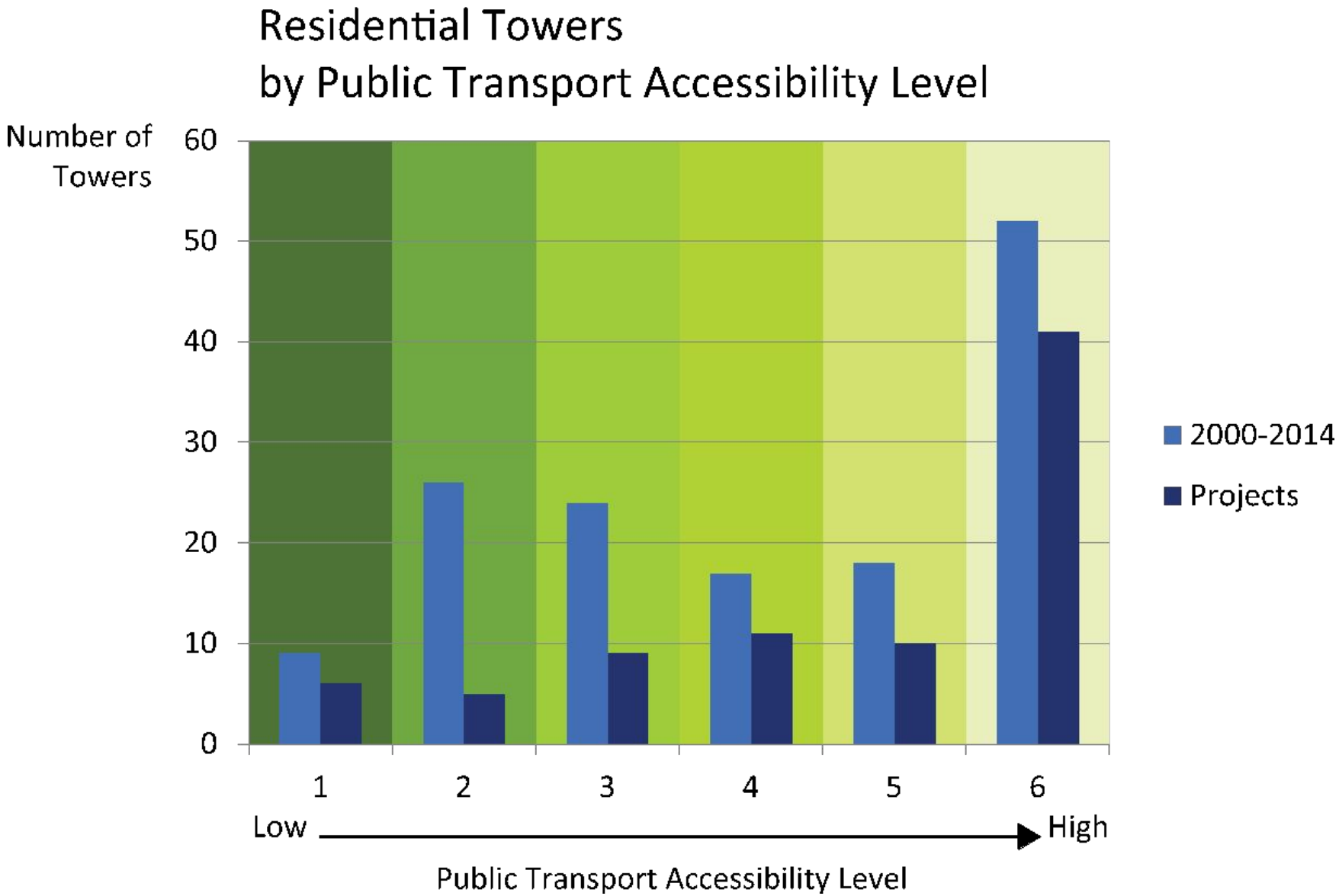

6
4
5
3
2
1
NbBatikm2
DensBati
RatioBati30
Hrel30
Hrel
HmoyInf30
HmoySup30
Hmoy
Hmax
RatioSurf30
IsVertiMean
IsVertiRatio
variable
0.0 2.5 5.0 7.5 10.0
value

ACCESSIBILITIES

- **Concentrating towers close to highly accessible locations**



- **Concentrating towers close to highly accessible locations**



To explore

Global Accessibility

- To principal points of interest
- To nodes of the public transport

Local accessibility

- Main basic commerces
- School, health services

….

Synthesis of discussions and schedule

Task 1	Who & when
1) Conceptual framework => explicit – the dimensions to take into account and links between them - the links between IDH and verticalization process and the way to explore them	September Manuel, Manoel, Hel & Julio …
2) IDH - work on specifications of the process of IDH computing - for Lyon check what is possible for IDH evolution	September (Hel, Mélanie, Julio, …)
3) Prices	September / Mélanie
4) Accessibilities: - Work on global/local accessibility index – common ?)	Lyon- September
5) Specifications and illustration of « Atlas on the web »	Mélanie, Hel, Manuel -September
6) Other analysis: - Morphology - Classification	